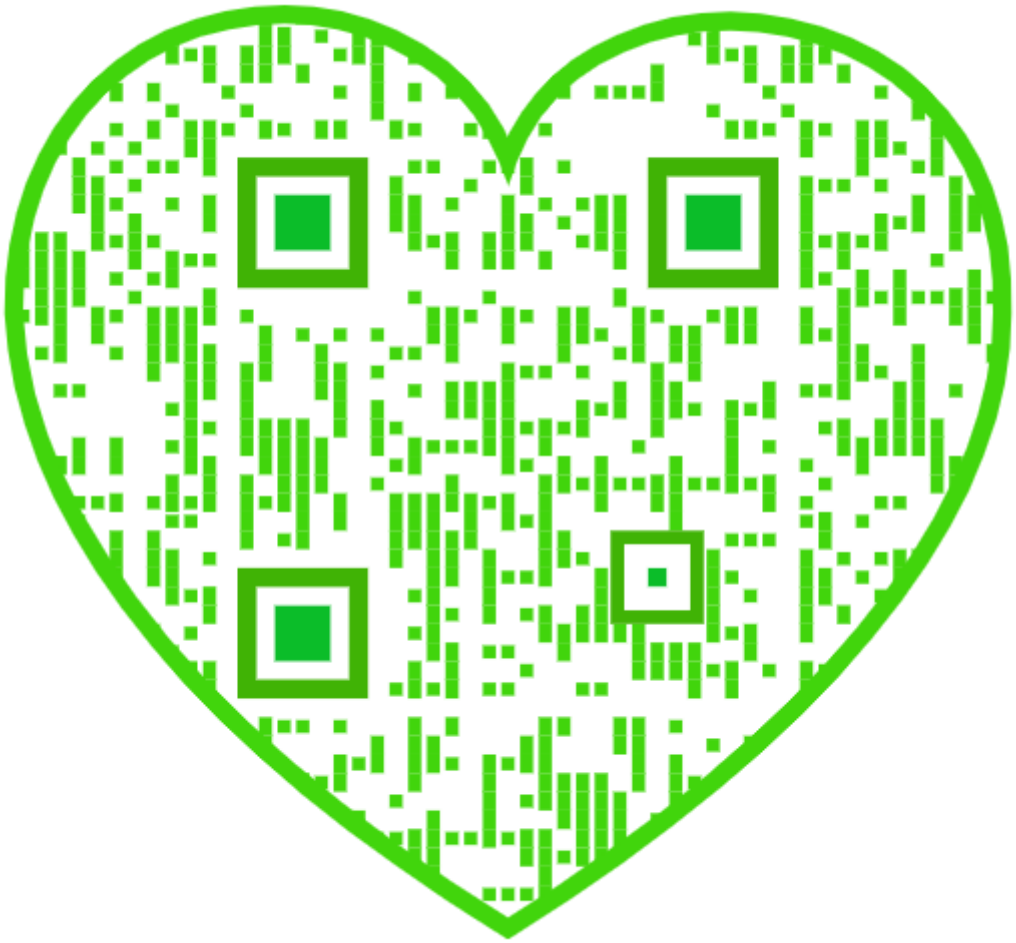

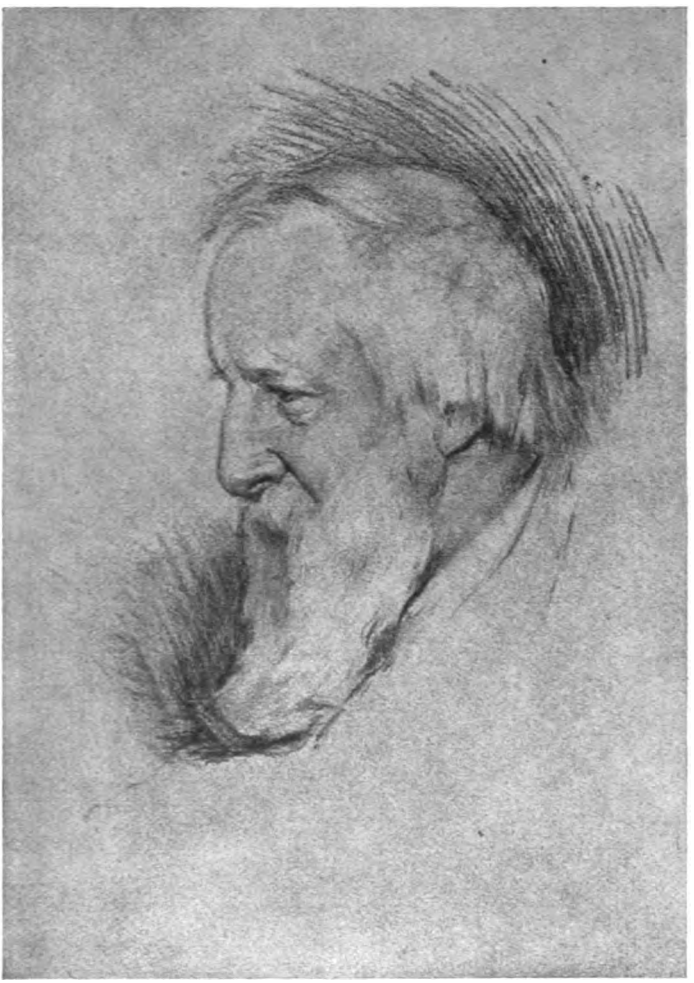

HENRY INGERSOLL BOWDITCH, M.D.

STATE SANITATION

A REVIEW OF THE WORK OF THE MASSACHUSETTS STATE BOARD OF HEALTH

BY

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VOLUME I

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TO

DR. HENRY PICKERING WALCOTT

SANITARY STATESMAN, LEADER IN PUBLIC HEALTH,
FOR TWENTY-EIGHT YEARS
CHAIRMAN OF THE STATE BOARD OF HEALTH OF
MASSACHUSETTS

44237

PREFACE

THE Massachusetts State Board of Health was established in 1869. For nearly fifty years it has been a power for good in the Commonwealth. How great an influence it has had in outlining and shaping constructive policies, few people of the present day realize. The Board carried on pioneer work in preventive medicine, in sanitation, and in the promotion of enterprises which make for human health and comfort. It has been a great moral force, its influence extending far beyond the bounds of the state. In many things it set the pace for the country, and its work is known and respected across the seas. Those who know the history of its work can appreciate the reasons for this success.

The State Board of Health was founded on a noble ideal, and has been supported by a sound public sentiment. Its organization and work have been non-partisan; its functions have been conceived to be advisory rather than coercive, educational rather than punitive, yet, when occasion required, it has not hesitated to demand the exercise of the police power of the state through its legal machinery. By co-operating with other state departments, metropolitan boards, and local authorities, it has given them the advantage of its knowledge and the services of its experts. The State Legislature has liberally supported it. And last, but by no means least, it has maintained a remarkable personnel—men of great and noble character, men whom the people of the Commonwealth will some day delight to honor, men who because of their constructive work in times of peace will be regarded as worthy of sharing the fame of those who helped to defend their country in time of war.

The primary object of this book is to set forth the past work of the Massachusetts State Board of Health so that it may be known by the people of the present generation. Since 1870 the Board has issued annual reports, besides which there have been many special and co-operative reports. In these reports are included some of the best articles on sanitation and public health which have ever been published in this country. Many of the older reports are now out of print and inaccessible except in libraries, while in the more recent reports, which have become voluminous, the reader hardly knows where to turn for information on particular subjects; consequently, these reports are not used as freely as they might be, and the older writings are in danger of being entirely forgotten.

A second object of this book is to bring to life some of these older writings, the ideas in which will often be found to be strikingly modern, by reprinting selected portions of them; and to make the later issues more useful by indexing the scientific reports and special articles. It is believed that the index to the reports of the Lawrence Experiment Station, in particular, will prove useful to students, engineers, and sanitarians. The index of outbreaks of disease, cross indexed according to cities and towns, ought to be useful to the physicians of the state.

A third object is to show how the work of the State Board of Health has fulfilled the ideals set forth in that remarkable document, the "Report of the Massachusetts Sanitary Commission of 1850," for which the state and country are indebted to the Concord school teacher, Cambridge bookseller, Boston publisher and publicist, — LEMUEL SHATTUCK.

The arrangement of the book needs some explanation. There are three volumes. The First Volume has two parts. Part I includes the author's history of the State Board of

Health. Part II contains the "Report of the Massachusetts Sanitary Commission of 1850," abridged for this work.

The Second Volume has two parts. Part III contains thirty-four articles, selected from the Annual Reports of the State Board of Health and the Monthly Bulletins. These articles have been chosen so as to be representative of the various activities of the Board, and representative of the leading officials who have taken part in the work. Part IV contains short abstracts of nearly all of the scientific articles and reports which were published between 1870 and 1914. They are arranged chronologically in order to show the evolution of thought in the realm of sanitation during nearly fifty years. These articles and abstracts may well serve as a reading course for present-day physicians and students in sanitation and public health. The author believes that they will also be of interest to all citizens of Massachusetts who take pride in their Commonwealth.

The Third Volume also contains two parts. Part V is intended to serve as a guide to the forty-six Annual Reports of the State Board of Health. In it may be found indices to the various sections of the reports arranged by subjects. The indices were prepared largely by the author and students in Harvard University, notably, Mr. Theodore R. Kendall and Mr. George W. Simons. Part VI comprises a series of biographical sketches of the engineers, chemists, and biologists of the State Board of Health who have been chiefly responsible for the great work accomplished and still being continued.

At the outset the author realized that if he were to attempt to write this history in full and well-balanced detail it would take more time than he had to give; he was therefore unwillingly compelled to limit his efforts to what could be accomplished within a fixed time. From this it necessarily follows that many sins of omission have been committed, a fact strikingly evident in the fifth chapter. He has tried,

however, to reduce errors to a minimum, but must depend upon his friendly critics to aid in discovering them.

So many friends have assisted him in the course of his work that it seems almost unfair to place his own name alone on the title page. Because of their number these friends must here be nameless, but to the members of the State Board of Health, to the present State Commissioner of Health, to the engineers, chemists, and physicians now and formerly in the employ of the state; to his colleagues and students in the School for Health Officers of Harvard University and the Massachusetts Institute of Technology; and lastly to his Secretary, Miss Dorothy E. Wakefield, who has helped to prepare much of the manuscript, the author wishes to express his cordial thanks, realizing that all have been working together in the interest of Public Health.

GEORGE CHANDLER WHIPPLE.

HARVARD UNIVERSITY,
November, 1916.

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PART I

HISTORY OF THE MASSACHUSETTS STATE BOARD OF HEALTH

CHAPTER I

EARLY HISTORY OF PUBLIC HEALTH IN MASSACHUSETTS

THE word " Health " does not appear in the Constitution of the State of Massachusetts,[1] but it must not be inferred from this that, in the early years, the state was unmindful of sanitation or of the health and comfort of the people. On the contrary, Massachusetts has always been one of the foremost states of the Union in this regard.

From the settlement of Boston in the year 1630 until the year 1647 frequent orders were passed by the " townsmen " regulating the internal health of the town but no measures were taken either by the government of Boston, or General Court of the Colony, to prohibit from landing vessels having cases of infectious sickness on board, or coming from infected ports. In 1647 information having reached the Colony of Massachusetts Bay that the " plague, or like grievous infectious disease," had " raged exceedingly in the Barbadoes, and other islands of the West Indies," and the Colony trading with them at the same time, it was considered highly expedient to enforce some measures to prevent the introduction of a disease so fatal in character. Accordingly the General Court, in March of that year or the next, passed their first order regulating quarantine of vessels from the aforesaid ports. This order, a copy of which is reproduced, was temporary in character, and repealed in about one year afterwards, probably on the termination of the epidemic.

Earliest Quarantine Regulations

[1] Adopted in 1780.

FIRST ORDER OF GENERAL COURT, REGULATING QUARANTINE OF VESSELS PASSED AT A SESSION OF THE GENERAL COURT THE FIRST MONTH MARCH, 1647 (OR 1648):

" For asmuch as this Co^rte is credibly informed y^t y^e plague, or like grievos in (fectious) disease, hath lately exceed^{gly} raged in y^e Barbadoes, Christophers, & oth^{rs} i (slands) in y^e West Indies, to y^e great depopulat^e of those, it is therefore ord^red, y^t all (our own) or oth^r vessels come^s from any pts of y^e West Indies to Boston harbor shall stop and come to an anchor before they come at y^e Castle, und^r y^e poenalty of 100£, & that no pson comeing in any vesell from the West Indies shall go ashore in any towne, village, or farme, or come within foure rods of any oth^r pson, but such as belongs to the vessels company y^t hee or shee came in, or any wayes land or convey any goods brought in any such vessels to any towne, villag^e, or farme aforesaid, or any oth^r place w^{th}in this iurisdiction, except it be upon some iland where no inhabitant resides, w^{th}out license from y^e councell, or some three of them, und^r y^e aforesaid poenalty of a hundred pounds for ev^{ry} offence."

" That no inhabitant, seaman, or other pson whatsoev^r, reciding w^{th}in this iurisdiction, shall go a board any such shipp or vessell comeing from the West Indies aforesaid, or buy or otherwise take into his possession any goods or marchandize brought in any such vessell, w^{th}out license as aforesaid, und^r y^e poenalty of 100 £, & to be otherwise confinedor restrained, as the said councell, or some three of them shall appoint; & to y^e end y^t all psons may have due information hereof, it is hereby agreed, y^t this ord^r shalbe forthw^{th} published, & a copy thereof sent to y^e Captaine of y^e Castle, togeth^r w^{th} commission to him to cause ev^ry ship or other vessell, belonging to y^e country or any oth^r place, y^t shall come from any pt of the West Indies aforesaid, to stop & come to an anchor before they shall passe y^e Castle, & then send unto them a coppy of this order, & there cause them to remaine till furth^r order from y^e Councell, or some three of them, whose counsell is to be taken therein; this ord^r to continue till this Co^rte or the Councell of y^e comon wealth shall see cause to repeal^e y^e same."

" It is furth^r ord^red, y^t a copy of this order shall beforthw^{th} sent to the sev^rall cunstable^s of ev^{ry} port towne in this iurisdiction, w^{th} warrant to give notice thereof, w^{th} all possible speed, to any vessell comeing from y^e West Indies aforesaid, upon y^e first view thereof, and furth^r to see to y^e execution of this ord^r, according to y^e utmost of their ability, & y^t y^e Councell, or some three of them, shall have pow^r to appoint

some convenient place, upon some of y^e^ ilands, or other fit places, where such psons & goods shalbe sheltered for a time, & to do any thing of like nature y^t^ shall be necessary for their preservation, and welfare of y^e^ country."

This order was repealed on 2d May, 1649, as follows:

"The Courte doth thinke meete that the order concerning the stoping of West India ships at the Castle should hereby be repealed, seeing it hath pleased God to stay the sicknes there."

After the repeal of the order, no quarantine was imposed on vessels until 1665.

Earliest Sanitary Regulations

As early as 1647, only seventeen years after the settlement of Boston, the General Court of the colony passed an act making it "unlawful for any person to cast any dung, draught, dirt, or any thing to fill up the Cove, or to annoy the Neighbours, upon penalty of forty shillings, the one half to the Country, the other half to the Wharfinger." By the "Cove" was meant the general region of what is now Haymarket Square, Boston.

In 1665 occurred one of the world's greatest tragedies, the plague of London, followed a year later by its counterpart, the great fire of London. Pepys in his inimitable diary has given us a graphic account of both of these catastrophes, while Daniel Defoe has left us what purports to be a Journal of the Plague Year, but which savors somewhat of the extravagances of Robinson Crusoe. One effect of the great plague was to arouse a new interest in sanitation, and no doubt this extended to the American Colonies. At any rate, we find that in 1666 the selectmen of the town of Boston made rules and regulations in regard to the work of scavengers. One of these reads as follows:

That noe inhabitant shall throw forth or lay any intrales of beasts or fowles garbidge or Carrion dead dogs or ratts dead beasts or any other stinking thing in any highway ditch or Common belonging to this towne but are injoyned to bury y^e^ same for the preventing of annoyance thereby and allsoe y^t^ noe person shall throw forth dust or dung, shreeds of cloth or leather, tobacco stalks or any other thing w^h^ may

tend to the annoyance of the streets upon penalty according to law puided and to be moderated according to y^e^ discretion of y^e^ Selectmen further it is ordered for the preuention of annoyance to the town, all garbidge, beast entralls etc. are to be throwne into the Mill Creek ouer the Mill Bridge upon penalty of 20 shillings fo^r^ euery default, and euery other person is to obserue s^d^ ord^r^ on s^d^ penaltie.

In 1678, following a severe outbreak of smallpox, the Plymouth Colony made sanitary regulations relating to the care of persons sick of smallpox and the disposition of their clothing. Similar regulations were made at Salem and elsewhere in the Colony.

In 1692 the Province of Massachusetts Bay passed an "Act for the Prevention of Common Nuisances arising by Slaughter-houses, Still-houses, Tallow Chandlers, and Curriers." In 1702 an act was passed appointing "Commissioners of Sewers." In 1742 an act was passed "to prevent the spreading of small-pox and other infectious sickness and to prevent the concealing of the same." In 1785 was passed an act against selling unwholesome provisions. In 1797 was passed what has been sometimes called the "Great Public Health Act," the object of which was "to prevent the spread of contagious sickness." It related largely to quarantine matters, and the Justice of the Peace and the Sheriff figured prominently in the execution of its provisions, but it authorized towns or districts to choose and appoint Health Committees or Health Officers to attend to various matters of sanitation.[1] Many of the old laws were repealed in 1836, when the Revised Statutes went into operation.

The "Great Public Health Act"

The idea of local self-government has always been strong in Massachusetts. Local boards of health were authorized seventy years before the State Board of Health was established, and it will be pointed out many times in this book that the functions of the State Board of Health have been chiefly advisory, many of the most important matters being left to

[1] These and other early acts pertaining to the public health will be found listed on a later page.

the local authorities. The New England towns, sometimes called "little republics," still continue to hold their democratic traditions, although in public health matters they are often guided by the experts of the state department of health.

The Paul Revere Board of Health

On February 13, 1799, the inhabitants of the town of Boston were empowered to choose a board of health, and it is interesting to remember that the first president of this board was Paul Revere.

The Boston Public Library contains the original manuscript records of the Board of Health of the Town of Boston from 1799 to 1810 in two beautifully kept and well preserved volumes. The following is a copy of the first page and part of the second page: —

On Saturday the Ninth day of March, 1799. . . . Agreeable to Notification from the Hon^ble^ Thomas Dawes & W^m^. Smith Esq^rs^ a Committee from the Hon^ble^ General Court of this Commonwealth, the Representatives of the several Wards in the Town of Boston, elected agreeable to an Act of the Legislature of this Commonwealth for the Establishment of a Board of Health, met at Faneuil Hall at Eleven o'clock. A.M.

Thomas Dawes & William Smith Esq^rs^ being present, the last mentioned Gentleman proceeded to read the Returns from the several Wards, and declared the Members who were severally present duly elected.

The Board then proceeded by Ballot to the Choice of a Secretary for the Ensuing Year; and Mr. John W. Folsom had a Majority of Votes, was duly elected, and he accepted the Choice.

The Committee having Retired the Board then proceeded to the Choice of a President for the Ensuing Year and directed the Secretary to collect and sort the Ballots, when it appeared Paul Revere Esq. had a Majority of Votes, was duly elected, and he accepted the Choice.

On a Motion That a Committee be Appointed to Prepare and Report, as soon as may be, Rules and Regulations for the government of the Board, passed in the Affirmative, and the following Members were Nominated and Appointed, viz.

Mr. Joseph Head
James Prince &
Paul Revere, Esq.

On a Motion That a Committee be appointed to Apply for the Use of the Senate Chamber at the Old State House, being an Eligible and convenient situation for the future Meetings of the Board, passed in the Affirmative, & John Winslow Esq. was Nominated and Appointed. Adjourned to Wednesday next 4 o'clock P.M.

The first annual report of the Board of Health is given as a single printed sheet, signed by Paul Revere, President, and J. W. Folsom, Secretary, dated Mar. 12, 1800.

The original act was amended several times between 1799 and 1816. When Boston became a city, in 1822, the town board of health was abolished, and from 1822 to 1873 public health matters were looked after by committees of the City Council. The town of Salem was authorized to choose a board of health in 1799; the town of Marblehead in 1802; the town of Plymouth in 1810; the town of Charlestown in 1818; the town of Lynn in 1821; the town of Cambridge in 1827.

The Paul Revere Board of Health, of Boston, gave its attention chiefly to matters of sanitation. The rules and regulations promulgated in 1799 now seem quaint and primitive. A few of these are quoted as illustrations:

Curious Sanitary Regulations

No hogsties or hogs shall be kept within the town without a license from the Board of Health, and except they stand over the water in such manner that the filth will be completely carried off by the ebbing and flowing of the tide.

No person shall be permitted to bring, sell or have in his possession within the town, any oysters, from and after the first day of June until the first day of September following, in each year.

No fresh fish shall be brought between the channel and the shore, or within the town, unless their throats have been cut, the blood cleanly washed off, and the gills and entrails taken out and thrown away, — salmon, eels, live and small fish excepted; nor shall any fresh fish remain on board any vessel, stall, fish-box or other place for a longer space than twelve hours without being salted.

No owner or keeper of a livery or other stable within the town shall have more than two cart-loads of dung at one time, proceeding from his

stable, from the first day of May until the first day of November then next following in each year.

All graves for the interment of the dead shall be at least six feet deep, and the proprietors of the several churches within the town under which dead bodies are or may be deposited, shall cause at least three bushels of lime to be slaked under each of them once every fourteen days, from the first day of June until the first day of October next following in each year.

No waste water shall be suffered to run upon the surface of streets from any house, building, or yard abutting on a street in which there is a common sewer, but the same shall be led therein by the owners of the buildings.

No feathers shall be landed within the limits of the town of Boston before the same have been examined by some person authorized for that purpose by the board of health and a certificate obtained from him that in his opinion the said feathers are free from infection and may be landed without danger to the health of the town.

Vaccination against Smallpox

The State had long been active in the control of nuisances like those just mentioned, but aside from quarantine, the first important public health measure in the line of preventive medicine was vaccination against smallpox. It therefore deserves more than passing notice, especially as it was in Massachusetts that the vaccination movement in America started.

In early times, and especially during the seventeenth century and among the Indians, the scourges resulting from smallpox were almost beyond our conception. Experience showed that one attack of the disease usually protected the individual against another, and this led to the belief that healthy individuals might be inoculated with "matter" from those suffering from the disease, and thus escape attack. This custom, spreading from India, had been introduced into England by Lady Mary Wortley Montagu. Rev. Cotton Mather and Zabdiel Boylston attempted to introduce the custom into America, in 1721, but met with bitter opposition. It was not until 1796, that vaccination with virus obtained from cowpox was undertaken in England by Dr. Edward

Jenner. A milk maid near Berkeley, England, where cowpox had become epidemic, was suddenly infected in one hand, through a scratch caused by a thorn. A genuine case resulted, and Jenner vaccinated a boy with lymph from the vescicles of cowpox on the hand of the milk maid. This was on May 14, 1796 — a memorable date. After a typical course, the boy was inoculated with variolus matter, and this was repeated several times after his acquiring the disease. Jenner's paper on the subject was published in 1798.

Dr. Waterhouse brings Knowledge of Jenner's Discovery

On March 16, 1799, Dr. Benjamin Waterhouse published in the *Columbian Centinel*, Boston, the first account given in this country of Jenner's discovery. It was called

"Something Curious in the Medical Line"

Everybody has heard of those distempers accompanied with pocks or pustules, called the smallpox, the chickenpox or if you like the term better, the cow-smallpox: or to express it in technical language, the variola vaccinae. There is, however, such a disease which has been noticed here and there in several parts of England, more particularly in Gloucestershire, for fifty or sixty years past, but has never been an object ot medical inquiry until very lately. As we are too often misled by names, it is not amiss to premise that there is nothing in the origen, nature or symptoms of this disorder anyhow resembling that incident to the human race, denominated lues.

This Variola vaccinae or cowpox, is very readily communicated to those who milk cows infected with it, but I never heard of one dying of it. . . . But what makes this newly-discovered disease so very curious and so extremely important, is that every person thus affected, is Ever After Secured from The Ordinary Smallpox.

Dr. Edward Jenner is the physician in England who has collected and arranged a series of facts and experiments respecting the disease called there the cowpox — His short work is commented on by Dr. George Pearson, physician to St. George hospital, London.

This imperfect sketch is thrown into the newspaper at this time with a view of exciting the attention of our dairy farmers to such a distemper among their cows.[1] It may also be gratifying to some of the faculty of medicine who, it is presumed, are not yet generally informed

[1] Possibly also to anticipate Dr. Jackson who was at this time in England studying the new theory. (G. C. W.)

of an epizootic disease, capable of being communicated from the brute to the human kind, and which, when communicated, is a certain security against the smallpox. The public anxiety has been roused of late to search after the cause of a destructive fever. Their attention has been directed merely to effluvia, vapoures or gasses, while they may here see a disease, the nearest a-kin to the smallpox of any yet known, which is never communicated by effluvia or medium of the air. It is highly probable that some of the most distressing distempers which affect mankind have an animal origin, and time may prove that the smallpox, whooping cough, and one kind of quinsy, have like the hydrophobia, a similar source. BENJAMIN WATERHOUSE.

CAMBRIDGE, March 12, 1799.

Dr. Waterhouse Vaccinates his Children

Vaccination was first performed in Boston, July 8, 1800, by Dr. Waterhouse.[1] He vaccinated seven members of his household, and six of these proved successful cases. Shortly afterwards, three of the children were sent to the smallpox hospital, and one was even inoculated with smallpox, but none of them contracted the disease. This act was by some regarded as rash beyond words; by others as an act of great heroism. In September, 1800, Dr. James Jackson, returning from England, added the weight of his young enthusiasm to the movement, and it soon became widespread. The discovery had its enemies, however. The system was opposed by many physicians, and denounced from many pulpits with great bitterness as an attempt to bestialize the race.

In June, 1801, Dr. Jackson endeavored to have the Board of Health of Boston undertake a series of experiments to prove the efficiency of cowpox as a preventive against smallpox, but public opinion was not yet ready to endorse such a movement. In the following year, however, Dr. Waterhouse repeated the application made by Dr. Jackson, accompanying it with a history of the disease, as well as the evidence of its efficacy which had been accumulated by medical societies in Massachusetts, New York, and elsewhere. The following extract from this memorial is worth reading.

[1] Dr. Waterhouse lived in a house, still standing, on Waterhouse St., Cambridge, facing the Common.

Memorial to the Boston Board of Health

The Memorial of Benjamin Waterhouse, M.D., Professor of the Theory and Practice of Physic in the University of Cambridge,

To The Board of Health in Boston.

Gentlemen,

No one can doubt the propriety of my addressing you on the subject of the new inoculation, who considers, that you are placed by law, as so many guardians of our lives, health, and safety. From recollection of that circumstance, I am induced, at this time, to address you, not as a private practitioner, but as the public teacher of the practice of physic in this Commonwealth; and am willing to annex to the assertions in this memorial the implied responsibility of my official station; for it has been, agreeably to an early declaration, under a serious impression of the duty imposed on me by the medical institution of this University, that I have laboured incessantly, for four years past, in the investigation and diffusion of the most important medical discovery, ever made since the world began; it being no less than that of exterminating the most loathsome and widely wasting pestilance, that Providence ever permitted to afflict the human race.

Being made acquainted, at a very early period, with this extraordinary discovery, I felt it my duty, as a teacher of medicine, to collect all the facts for the information of those who attended my public lectures. Having imported the disease itself into America, I feel, if possible a still stronger obligation to acquaint the public with every step I took in diffusing it, even before it passed the limits of my own family, I therefore published all my proceedings from time to time in the newspaper, in a style so simple as to require no other preparation than common sense and an unprejudiced mind. But as they have never yet been collected together in one book, it may be of some use, on this particular occasion, to throw together the leading particulars, and lay them in order before the public, through the respectable medium of the Boston Board of Health. For really, gentlemen, seeing vaccination is marching triumphantly over the globe, and PRESIDENTS, EMPERORS, KINGS, CONSULS, and PARLIAMENTS, are giving it public countenance and support, it is time for BOSTON, distinguished as " the headquarters of good principles," to consider whether they will choose to be the last in adopting a practice, which has been followed by France, Italy, Spain, Germany, Prussia, and Constantinople, and even received with warmth in the cold regions of Russia and Norway.

It has been to me a humiliating reflection that the very plans I have offered for a Vaccine Institution in Boston, for inoculating the poor

gratis, and which have been received with a chilling apathy and a repellant suspicion, have, on being transmitted to some of the middle and southern states, been adopted with alacrity. . . .

Memorial to the Boston Board of Health

Let us then no longer be told of the contemptible origin of that benign remedy, which PROVIDENCE has destined for the preservation of our offspring from a loathsome and destructive plague. The earth maintaines not a more clean, placid, healthy, and useful animal than the Cow. She is peculiarly the poor man's riches and support. From her is drawn, night and morning, the food for his ruddy children; while the more concentrated part of her healthy juices is sold to the rich, in the form of cream, butter and cheese. It would indeed be uncomfortable to live without this animal, as she supplies man with more conveniences, and at a less expense, than any other quadruped in the creation. When we have exhausted her by age, her flesh serves for our nourishment, while every part of her has its particular uses in commerce and medicine. On these accounts she is an useful, though invisible wheel in the great machine of state. Hence we cease to wonder that this useful domestic animal was consecrated among ancient nations, as an object of worship.

You will readily see, gentlemen, that this memorial, though meant to carry every mark of respect, is not made in the style of cringing solicitation, like a man exclusively interested in the event, and actuated by personal motives merely; but of a man conscious of his duty, and zealous in promoting a public benefit every way worthy your patronage; a benefit of more real value to the town of BOSTON, than all the riches contained within its limits. You will also remember, that the main object of this address is not to persuade you blindly to patronize the new inoculation but to induce you to cause a rigid inquiry to be made into the truth of my assertions, and to have them subjected to the test of a PUBLIC EXPERIMENT by a set of men, whose knowledge, age, and virtues, will create confidence, and inspire satisfaction.[1]

BENJAMIN WATERHOUSE.

CAMBRIDGE, May 31, 1802.

Dr. Waterhouse finally succeeded in convincing the Board of Health of the wisdom of some such action, and, as a result, the Board of Health made the following announcement:

The Board of Health for the town of Boston, are happy to have it in their power, this day, to announce to their fellow-citizens the re-

[1] That is, a committee of six of the oldest physicians, and six of the oldest clergymen in Boston, together with Dr. Aspinwall.

sults of one of the most complete experiments which perhaps has ever been made, to prove the efficacy of the Cow-Pox, as a preventive against the Small-Pox; and while they take the liberty to congratulate the public on this important discovery, they do earnestly recommend its introduction generally, and are confident that it will be the means of preserving the lives and adding to the happiness of millions.

President Thomas Jefferson a Convert to Vaccination

President Thomas Jefferson corresponded with Dr. Waterhouse in regard to the new virus, and his children were among the first persons in the country to be vaccinated.

The physicians of Boston were not alone in experimenting with vaccine and applying it in a practical way. The following memorial is worthy of preservation:

MILTON, 25th October, 1809.

Children vaccinated at Milton

The twelve children whose names are written on the back of this card were vaccinated by Dr. Amos Holbrook at the town inoculation in July last, they were tested by smallpox inoculation on the 10th Instant and discharged this day from the Hospital after offering to the world in the presence of most respectable witnesses who honored Milton with their attendance on that occasion, an additional proof of the never failing power of that mild preventive the Cow pock against smallpox infection; a blessing great as it is singular in its kind, whereby the hearts of men ought to be elevated in praise to the Almighty Giver.

RUFUS PIERCE, JNO. MARK GOURGAS.
JASON HOUGHTON, JEDIDIAH ATHERTON.
JOSHUA BRIGGS,
SAMUEL ALDEN,
THOMAS STREET BRIGGS,
BENJAMIN CHURCH BRIGGS,
MARTIN BRIGGS,
GEORGE BRIGGS,
CHARLES BRIGGS,
JOHN SMITH,
CATHERINE BENT,
SUSANNA BENT,
RUTH P. HORTON,
MARY ANN BELCHER.

When Boston became a city, in 1822, the charter provided that public health matters should be carried into execution by the appointment of health commissioners, or in such other manner as the health, cleanliness, comfort, and order of the city might, in the judgment of the City Council, require. Three commissioners were appointed, but as they stood in the way of certain reforms desired by the administration, they were removed. Mayor Josiah Quincy was a man of large vision, and some of the present institutions of the city date from his time. He established a regular system of street cleaning and a system for the collection of house offal, he reorganized the fire department, and founded a new market,—Faneuil Hall Market, which had been in use since 1742, being supplemented by Quincy Market, opened in 1827. This was a measure carried out in the interest of both sanitation and business economy. The detailed work in public health matters was carried on by Committees on Internal Health, on External Health, on Streets, on Drains and Sewers, on Water, and on Burial Grounds.

Public Health in Boston under Mayor Josiah Quincy

It was not until December 2, 1872 that an ordinance was passed establishing the Board of Health of the City of Boston. This was just after the Great Boston fire, which began on November 8, 1872, and burned for several days, destroying the business section from Washington Street near Summer and Franklin Streets, in an easterly direction, to the harbor. This fire gave rise to sanitary and reconstruction problems of an important character. The first members of the Boston Board of Health were Alonzo W. Boardman, Dr. Samuel H. Durgin, and Albert T. Whiting; their first annual report was published in 1871 — the earliest of a long series of important documents which is still continued.

The Boston City Board of Health

This book is not a sanitary history of Boston — that is a subject worthy of a volume by itself — yet it would be ungrateful not to pause long enough to consider the magnifi-

Dr. Durgin's Work

cent service performed by Dr. Durgin, one of the members of the original Board of Health, who served the city faithfully and most efficiently until 1912, when he was retired with a life pension. Dr. Durgin's influence was much wider than his own city. Naturally, he was associated with the officials of the State Board of Health in their consideration of the sanitary problems of Boston; while his high scientific attainments and his successful public health administration gave him a national reputation. His name is one which the city and state delight to honor.

So much attention has been given by the State Board of Health to the water supply and sewerage of Boston that for the sake of completeness it is fitting to refer briefly to the early history of these services.

Early Water Supplies of Boston

Prior to 1795 the people of Boston obtained their water supplies from wells; in fact, wells were largely used until after the introduction of Cochituate water in 1848. The wells, situated on the slopes of the three hills, furnished an ample supply, but the water was hard and sometimes polluted and neighbors quarreled over their supplies, the deeper wells drawing the water away from shallower ones. On the lowlands water was scarce. In 1834, a count made by Eben A. Lester showed 2767 wells, of which 2085 gave " drinkable " water and 682 gave " bad water." In only seven wells was the water soft enough to be used for washing, and for the most part, rain water collected in cisterns was used for this purpose; 427 wells were reported as failing at times, 62 were affected by vaults or drains, and 134 were turbid or brackish.

Water Supply from Jamaica Pond

In 1795 the Boston Aqueduct Company was incorporated for the purpose of bringing water into the city from Jamaica Pond, at that time within the township of Roxbury. In 1833 this supply was described by Loammi Baldwin in a report to a committee of the directors, from which the following abstracts have been made.

The area of Jamaica Pond at the time of the survey was sixty-seven acres; the elevation of the water one foot above the lower side of the effluent pipe was fifty feet above tide level. The pond surface ordinarily stood five feet above the pipe, but in 1822 to 1823, the aqueduct stopped for want of water, and there was a serious shortage for several months. The quality of the water was soft and satisfactory.

Conduit of Wooden Pipes

The conduit, which consisted chiefly of wooden pipes, that is, bored logs, extended through Roxbury, across Boston Neck, now Washington Street, to Essex Street, then, by way of Short Street, Bedford Street, Summer Street, and Purchase Street, to a reservoir at Fort Hill. There were, of course, various branches from the main line. The distance from the pond to the reservoir was 4.85 miles. The elevation of the bottom of the effluent pipe in the pond was only eight feet above the top of the reservoir, and thirty-four feet above the reservoir bottom. As for the pipe line itself, the water was drawn from the pond through two wooden pipes, five inches in diameter. After a short run, these came together into a single eight-inch cast iron pipe, evidently a replacement of previously existing wooden pipes, which was 3150 feet long. This was followed by a double line of five-inch wooden pipes; then by two three-inch and two four-inch pipes, these four-inch pipes continuing to the reservoir. Various combinations of pipes were used on the other lines, now four-inch, now three-inch, and again five and three-quarter-inch.

Some of the connections were curiously made. One method was by the use of " saddles." About two feet of log was left unboxed where the connection was to be made, and a lead pipe, two and one-half to three inches in diameter, bent in the form of a basket handle, was inserted at each end into one of the wooden pipes just behind the solid portion. Again, where a large pipe branched into two small pipes, a bored log thirty feet long was laid at right angles to the line, the larger

pipe entering at one side, and the two smaller pipes taking off from the other side.

After a time, the pipes began to leak badly, and were tested for leakage in a peculiar way, namely, by inserting thin plates of iron in slits across the pipes at two points a few hundred feet apart, known as "gates." An inch hole was then bored in the pipe on each side of the upper gate, a tin tube was introduced into the hole between the gates, and filled with water from the pipe above the gate. If the water in the tin tube disappeared, it was an evidence of leakage between the two gates.

Between the leakage, the friction, and the small available head, it is said that the reservoir played an insignificant part in the water works system.

New Water Supplies proposed

By 1816, the Jamaica Pond supply had become inadequate, and it was suggested that Spot Pond be used as a source of additional supply. In 1825, the City investigated this project, and for several years it was vigorously urged. In 1833, Colonel Loammi Baldwin, by appointment of the city authorities, made a thorough study of the whole situation, and pointed out the great advantages of a supply from Farm Pond and Long Pond (i. e., Lake Cochituate). The aqueduct which he suggested followed the Charles River almost to Dedham, thence through Roxbury over Boston Neck. No immediate action was taken, and other sources being also suggested, namely the Charles River and Mystic Lake, chaos reigned. In 1837 a Boston commission made a divided report, two members favoring Spot Pond, and one favoring Long Pond; supplementary reports were made in 1839. Then followed several years of rigid economy, during which nothing was accomplished, but in 1843 the various projects were again discussed. Finally in 1845, after another Boston commission had reported, a joint special committee of the Legislature took up the question, gave hearings, which

required twenty-six sessions, and as a result recommended the passage of a bill authorizing the City to supply the city proper and South Boston with water from Long Pond. This act was passed March 30, 1846, was accepted by the legal voters of the city on April 13th, and ground was broken for the aqueduct August 20, the name of Long Pond being changed to Lake Cochituate. It is interesting to note that on this occasion the first shovelful of earth was thrown by Josiah Quincy, Mayor of Boston, and the second by John Quincy Adams, Ex-President of the United States.

Lake Cochituate Supply adopted

Thus ended a bitter controversy which had lasted for twenty years, and in the course of which there were not only official reports, but many addresses and memorials, privately printed and distributed, notably by John H. Wilkins, Lemuel Shattuck, Henry B. Rogers, Walter Channing, and Henry Williams.

In 1834 Professor Charles T. Jackson made chemical analyses of water samples for Loammi Baldwin by methods that now seem very crude. He added silver nitrate to the water, which he allowed to stand in the sun; a black precipitate indicated the presence of organic vegetable matter. He then tested with oxalate of ammonia, absence of precipitate indicating absence of lime; with muriate of barytes, absence of precipitate indicating absence of sulphates; with ferrocyanate of potash, absence of precipitate indicating absence of iron; with lime water, absence of precipitate indicating absence of carbonic acid, and finally with alcoholic soap solution, a good froth showing that the water was well adapted for washing. In 1845, however, Professor Benjamin Stillman, Jr., of Yale College, made a much more extensive study, in the course of which he considered the possible action of various waters on lead pipe and the danger of lead poisoning. In 1848 and 1849, Professor Horsford, of Harvard College, investigated the effect of Cochituate water

Old Fashioned Water Analyses

on iron and lead, in connection with the question of service pipes.

Introduction of Cochituate Water

After the Cochituate project had once been begun, the work was prosecuted with such energy that in twenty-six months the works were completed. On October 14, 1848, the masonry reservoir on Beacon Hill, back of the State House, was filled, and on October 25, the great celebration took place on Boston Common, where the fountain played for the first time in the presence of the city authorities and a great concourse of people. On this occasion, James Russell Lowell read his well-known Ode on the Introduction of Cochituate Water, from which the following lines are quoted:

> My name is Water: I have sped
> Through strange, dark ways, untried before,
> By pure desire of friendship led,
> Cochituate's ambassador:
> He sends four royal gifts by me
> Long life, health, peace, and purity.

The work was carried out by a board of three Water Commissioners elected by the City Council, Nathan Hale, James F. Baldwin, and Thomas B. Curtis. John B. Jervis, of New York, was consulting engineer. E. S. Chesborough and William S. Whitwell were chief engineers of the Western and Eastern Departments of the works, respectively. This board made its final report in 1850, and in that year the Cochituate Water Board was established, the general superintendency of the works being delegated to the City Engineer, E. S. Chesborough.

Sewerage of Boston

Eliot C. Clark in his description of the Main Drainage Works of Boston, published in 1885, has given an account of the early history of sewage in Boston from which the following is a brief abstract.

Boston was first settled in 1630. When the first sewer was built cannot now be determined, but it was earlier than the

year 1700, for already, in 1701, the population being about 8,000, a nuisance had been created by frequent digging up of streets to lay new sewers and to repair those previously built; and in town meeting, September 22, 1701, it was ordered, "That no person shall henceforth dig up the Ground in any of the Streets, Lanes or Highways in this Town, for the laying or repairing any Drain, without the leave or approbation of two or more of the Selectmen."

The First Sewers

The way in which sewers were then built was, apparently, this. When some energetic householder on any street decided that a sewer was needed there, he persuaded such of his neighbors as he could to join him in building a street drain. Having obtained permission to open the street, or perhaps neglected this preliminary, they built such a structure as they thought necessary, on the shortest line to tide-water. The expense was divided between them, and they owned the drain absolutely. Should any new-comer, or any neighbor who had at first declined to assist in the undertaking, subsequently desire to make use of the drain, he was made to pay for the privilege what the proprietors saw fit to charge. When a drain needed repairing, all persons using it were expected to pay their share of the cost.

As might have been expected, under such a system, great difficulty was experienced in distributing the expenses fairly, and in collecting the sums due. These matters became of sufficient importance to engage the attention of the Legislature, and in 1709, an act was passed regulating them. It is entitled, "An Act — Passed by the Great and General Court or Assembly of her Majesty's [1] Province of the Massachusetts-Bay. For regulating of Drains and Common Shores.[2] For preventing of Inconveniences and Dammages by frequent breaking up of High-Wayes . . . and of Differences arising among Partners in such Drains or common Shores

[1] Queen Anne. [2] Sewers.

about their Proportion of the Charge for making and repairing the same."

The act recites " that no person may presume to break up the ground in any highway within any town for laying, repairing or amending any common shore, without the approbation of the selectmen, on pain of forfeiting 20 shillings to the use of the poor of said town; that all such structures, for the draining of cellars, shall be 'substantially done with brick or stock.' " [1]

The old Sewers not allowed to receive Sewage

For one hundred and fifteen years the sewers in Boston were built, repaired, and owned by private individuals under authority of this act. It may be doubted if most of them were " substantially done with brick or stock," and there certainly was much difficulty about payments, so that, in 1763, the act of 1709 was amended to provide for the payment of the cost of repairs. (No further change was made until 1796.) Under this act the greater part of Boston was sewered by private enterprise. The object for which the sewers were built was, as indicated " for the draining of cellars and lands." The contents of privy-vaults, of which every house had one, and even the leakage from them, was excluded; but the sewers received the waste from pumps and kitchen sinks, and also rain-water from roofs and yards.

That much refuse got into them is proved by their frequently being filled up, and, as they had a very insufficient supply of water, they were evidently sewers of deposit. That they served their purpose at all is due to the fact that the old town drained by them consisted of hills with good slopes on all sides to the water. Of this early method of building sewers, Josiah Quincy, then mayor, said, in 1824: " No system could be more inconvenient to the public, or embarrassing to private persons. The streets were opened with little care, the drains built according to the opinion of private

[1] Stone.

interest or economy, and constant and interminable vexatious occasions of dispute occurred between the owners of the drain and those who entered it, as to the degree of benefit and proportion of contribution."

One of the first acts of the new city government, in 1823, was to assume control of all existing sewers and of the building and care of new ones. The new sewers were built under the old legislative acts, and, as before, the whole expense was charged to the estates benefited, being divided with reference to their assessed valuation. A small, variable portion of the cost was, however, generally assumed by the city, in consideration of its use of the sewers for removing surplus rainwater from the public streets.

The new Function of Sewers

Fecal matter was rigidly excluded until 1833, when it was ordered that, while there must be no such connection between privy-vaults and drains as would pass solids, the Mayor and Aldermen, at their discretion, might permit such a passage or connection as would admit fluids to the drain. This action was perhaps due to an advent of cholera during the previous year. To assist in flushing out deposits, it was provided, in 1834, that any person might discharge rainwater from his roof into the sewers, without any charge for a permit. The same year, control of the sewers and sewer assessments was given to the City Marshal. That there might be some one to give his whole time to the financial and administrative duties connected with the sewerage system, a "Superintendent of Sewers and Drains" was appointed in July, 1837.

Under city management the sewers discharging into the harbor developed so rapidly that in 1869 there were 100 miles of sewers; in 1873, 125 miles; and in 1885, when the Boston Main Drainage was installed, 226 miles.

During the last century the contours of Boston have undergone striking changes, the transformations giving rise to sanitary problems which were troublesome and perplexing.

Filling Land in Boston

At the time of the Revolution, Boston had her three hills, Beacon Hill, Copp's Hill, and Fort Hill — whence the name Tremont Street — and around these there were indentations in the coast line. Only a narrow neck of land connected the city with the old town of Roxbury, along the line of our present Washington Street. This was awash at very high tides. During the Revolution, the Neck was cut by the British soldiers, so that for a time Boston was an island.

As the city grew, the coves were developed for water power purposes by throwing dikes across them and utilizing the tidal flow through the sluices. The North Cove, or the Mill Pond, which extended from the North Station nearly to Hanover Street was filled, during the years 1804 to 1829, with earth from the top of Beacon Hill. This added about seventy acres of land to the city. Similarly, the West Cove, eighty acres in extent, was filled, during the years 1803 to 1833, with material from West Hill, a knoll on one of the spurs of the west side of Beacon Hill. The Massachusetts General Hospital stands on land thus made. On the other side of the city, South Cove was filled, during the years 1806 to 1843, making the land on which the former Boston and Albany and Old Colony Stations, and the present South Station, were located — one hundred and eighty-six acres in all. The filling of Great Cove, on the market side of the city, was begun in 1823, but it was not until 1868 that Atlantic Avenue was built, and it was 1874 before the project was completed. The material used for filling South Cove and Great Cove was obtained partly from swamp land, partly by dredging the channels, but largely by the leveling of Fort Hill. In all, the filling of Great Cove added five hundred and seventy acres to the area of old Boston.

The Back Bay

The most notable project, however, was the filling of the Back Bay lands during the years 1857 to 1881. As early as 1814, the Boston and Roxbury Mill Corporation was granted

the right to build a dam — called the Mill Dam — from the corner of Beacon and Charles Street to Brookline, along the line of Beacon Street, with a cross-dam on the line of Brookline Avenue. The object was to use the tidal flow from a full to a lower basin for power purposes. The mills were used for many years. In 1839 the Boston and Providence Railroad was granted the right to cross this basin to its terminus at Park Square. Meantime, the city had acquired rights to discharge sewage into the basin, and by 1849 this had become a serious public nuisance. At the same time, also, the site of the Public Gardens was used as a general dumping ground for ashes and other refuse, so that the shores of the Common were most unsightly.

Filling the Back Bay

In 1852, a legislative committee advised the abandonment of the water power and mill business and the filling of the Back Bay, with due provision for " streets of great width and straight course," and for proper drainage. In 1856 an agreement was made between the State, City, and Corporation, and a second one in 1864, known as the Tripartite Agreement, according to which the city was to build certain sewers, and the state and corporation were to do the filling. The streets were built to grade eighteen above city base, and the lots to grade twelve, the depth of filling being fifteen and nine feet respectively. A large amount of the material for filling was obtained from the town of Needham brought in over a railroad through Brookline and Newton Highlands, which afterwards became a part of the " Circuit " line of the Boston and Albany system. This was a highly profitable venture for all parties. The Commonwealth received over four and a half millions of dollars from the sale of land, the filling of which had cost but little more than one and a half million. The reclaimed land had an area of one hundred and twelve acres, and its importance to the present city cannot be overestimated. It would be hard to conceive what Boston would

be like today without this area, without the public gardens and Copley Square, and without the approaches to the city over Beacon Street, Boylston Street, Huntington Avenue, Columbus Avenue, and Tremont Street — all of which were under water less than a century ago. It was a city planning project of no mean proportions.

During the process of filling, unsanitary conditions at times arose from the decomposition of the organic matter in the stagnant salt water over the area. The opponents of the project prophesied that dire calamities would follow, but as the work progressed the conditions improved, and when the advantages to the city and state had become evident, the prophets of evil joined with the others in praise of the work.

Local Boards of Health

Although local boards of health created by special acts existed in several cities before 1849, it was not until that year — one of the cholera years — that a general act was passed giving all towns respecting which no provision had been made permission to choose boards of health, and providing that in towns becoming cities the functions of these boards should devolve upon the city council. This act resulted in the establishment of many public health organizations throughout the state, and paved the way for the central organization which followed twenty years afterward.

Ether first used as an Anaesthetic

It was about this time that Ether was " discovered." Although not strictly a part of preventive medicine the discovery by Dr. Morton, in 1846, that sulphuric ether would produce anaesthesia was an event of epoch-making importance, and added prestige to Massachusetts scientists. A complete account of this discovery may be found in Harrington's " History of the Harvard Medical School," from which the following notes have been taken.

Dr. W. T. G. Morton, a young dentist, born in Charlton, Mass., in 1819, was taken into the office of Dr. Charles T.

Jackson in 1844, as a medical assistant. Dr. Jackson, besides being a physician, was one of the first scientists of his day, and had claimed the honor of being the discoverer of gun-cotton and the electric telegraph. On one occasion, Morton had a patient who wished to have a sensitive tooth filled, and Jackson advised him to apply chloric ether to the gums. The success of this trial led to further studies by Morton with the result that he succeeded in developing a satisfactory method of administering sulphuric ether. Wishing to profit financially from his discovery, he arranged with his attorney, Richard H. Dana, Jr., the author of the well-known book, "Two Years before the Mast," to patent his process. This was kept a secret from Dr. Jackson, who meantime had himself come to appreciate the value of suphuric ether in producing anaesthesia. On September 30, 1846, Dr. Morton, who had previously been experimenting upon himself, used sulphuric ether in connection with the extraction of a tooth from one of his patients, Eben H. Frost. Frost certified to the result of this painless operation, and this being published, at once attracted attention. A controversy arose between Dr. Morton and Dr. Jackson as to who was the originator of the idea—a controversy which has caused much bitterness of feeling. Regardless of the question of priority, it seems to be well authenticated that it was Dr. Morton who first fully appreciated the importance of the use of this substance. In October, 1846, Dr. Morton used sulphuric ether in connection with an operation for congenital tumor, conducted by Dr. J. C. Warren. This was the first public operation of its kind, and was witnessed by many who were before incredulous. The operation was successful, and when the patient recovered consciousness, he declared that he had suffered no pain. Dr. Warren turned to those present and said, "Gentlemen, this is no humbug. The conquest of pain has been achieved."

Dr. Morton etherizes Patient for Dr. Warren

Morton continued his experiments, and through the confidence and co-operation of Dr. Henry J. Bigelow a satisfactory method was found for administering the ether, while Bigelow made the important discovery that the pulse was the true criterion between safety and danger in administration. The first formal public declaration that a safe and unfeeling method of destroying pain had been discovered was made at a meeting of the American Academy of Arts and Sciences in Boston, on November 3, 1846. The news quickly spread throughout Europe, and before the end of January, 1847, "the great American Discovery" was a world-wide topic of discussion. At first the agent was called "letheon," but Dr. Oliver Wendell Holmes, to whom the question was referred, objected to this, and the words anaesthesia and anaesthetic are now firmly fixed in the language.

This brilliant discovery was followed by some unpleasant controversies in regard to obtaining rights, royalties, and the like, but these have been long since forgotten, and we have lived to see fulfilled the prophetic words of the venerable Jacob Bigelow, who at the semi-centennial of the birth of anaesthesia said: "The suffering and now exempted world have not forgotten the poor dentist, who, amid poverty, privation, and discouragement, matured and established the most beneficial discovery which has blessed humanity since the primeval days of Paradise."

Dr. Oliver Wendell Holmes praises Anaesthesia

Those who tell the story of the discovery of ether are fond of quoting the words of Dr. Oliver Wendell Holmes, who in an address to his class of medical students at the Harvard Medical School in 1847, said:

> Here almost within the present year, the unborrowed discovery first saw the light, which has compassed the whole earth before the sun could complete his circle in the zodiac. There are thousands who never heard of the American Revolution, who know not whether an American citizen has the color of a Carib or a Caucasian, to whom the name of Boston is familiar through the medical discovery. In this very hour

while I am speaking how many human creatures are cheated of pangs which seemed inevitable as the common doom of mortality; and lulled by the strange magic of the enchanted goblet, held for a moment to their lips, into a repose which has something of ecstasy in its dreamy slumbers.

The knife is searching for disease, the pulleys are dragging back dislocated limbs, nature herself is working out the primal curse which doomed the tenderest of her creatures to the sharpest of her trials, but the fierce extremity of suffering has been steeped in the waters of forgetfulness, and the deepest furrow in the knotted brow of agony has been smoothed forever.

Lemuel Shattuck and his Ideals

We now come to a man who did more for the state than the people of Massachusetts have ever appreciated — Lemuel Shattuck. A short account of his life will be found in Chapter XIII. Several volumes of his life and collected writings may be found in the library of the New England Historical Genealogical Society. Shattuck was not a medical man, but a schoolteacher, bookseller and publisher. By successive studies of local history, genealogy, vital statistics, and public health, he gradually evolved an ideal for public health administration, which he set forth in concrete form in the report of the Massachusetts Sanitary Commission of 1850.

He did not reach this ideal in a single bound, and it is instructive to follow what was probably the sequence of his thoughts. In 1837, he devised a plan for arranging, printing, and preserving the Boston city documents; in 1841, he published a system of recording genealogical facts; in 1842, he secured the passage of the act on which the present Massachusetts system of registration of births and deaths is based; in 1845 he made a census of Boston which was in the nature of a sanitary survey. From 1847 to 1849 he urged the passage of an act by the Legislature to authorize the making of a sanitary survey of the state. This act was passed in 1849, and he was made a member of the Sanitary Commission. He wrote the report with practically no assistance

from his two colleagues, and it was published in 1850 — a monumental volume, which contained the outline of a state system of Public Health Administration so comprehensive that even today it may well serve as an ideal for future realization.

But what happened as the result of his labors? At the time, nothing at all. The report, as Dr. Bowditch has said, "fell stillborn from the hands of the state printer." Eight years later, Governor Banks, who had been a member of the Sanitary Commission, did not even remember that he had signed the report. The volumes themselves were largely consigned to the dusty attic of the State House, to be discovered in later years by Dr. Walcott. Writing of Lemuel Shattuck, Dr. Bowditch said: "I remember him well. Calm in his perfect confidence in the future of preventive measures to check disease, he walked almost alone in the streets of his native city [1] not only unsustained by the medical profession, but considered by most of them as an offense, for his earnest defense of what seemed to the majority of us physicians out of a layman's sphere, and withal, of trifling moment compared with our usual routine of so called 'practice.'" The public, ignorant of hygiene, treated him no better. Nevertheless, the ideas in his report germinated slowly but surely, and twenty years afterward, Dr. Derby, the first Secretary of the State Board of Health, acknowledged that he looked to the report of the Massachusetts Sanitary Commission for his inspiration and support. Thirty years later Dr. Walcott did the same.

Preventive Medicine

Looking back now these seventy years, it seems almost the irony of fate that preventive medicine, boldly outlined by a layman who was spurned by the medical profession as one who rushed in where angels feared to tread, should not only acquire recognition but become well-nigh separated

[1] Meaning Boston, although Mr. Shattuck was born in Ashby, Mass.

from that profession, or more accurately from that part of the medical profession which strives to cure individuals of their ills. Indeed, the science of medicine has broadened — medical practitioners have themselves broadened — and the boundaries between different branches of science have faded as knowledge of nature's processes has increased. Engineers, statisticians, chemists, biologists, are now working harmoniously with physicians, to protect the public health and to cure the individual. More and more, physicians will practice the arts of prevention; more and more laymen will co-operate with them in doing so. The end will be that prevention and cure will go hand in hand.

Digressing slightly to expand this idea, it may be called to mind that historically cure has generally preceded prevention. Just as curative medicine preceded preventive medicine, so methods of extinguishing fires preceded methods of fire prevention, methods of the punishment of crime preceded methods of preventing crime, methods of flood protection preceded the present efforts to prevent floods, and in these days of the Great War may not the world look forward to a rational pacificism, a preventive militarism which will supplement, but not abolish, the military forces required by the nations to preserve order and prevent war? Oh, for a Lemuel Shattuck to outline a comprehensive program of action!

The Massachusetts Sanitary Commission of 1850

The report of the Sanitary Commission was published, as has been said, in 1850. It was a document of more than five hundred pages — admirably written, logical in its arrangement, comprehensive in its scope. The Commission had been asked to prepare and report a plan for a sanitary survey of the state. It did much more than this; it prepared an outline for a complete state department of health, and did so in a very detailed way. The sanitary survey which it proposed was to be put upon a permanent basis; the entire state was always to be under survey.

This report is so important that it has been abstracted at some length, and the reader is requested to read this abstract (pages 241 to 349) before going on with the next chapter. There were two introductory parts, covering, in the original report, about one hundred pages. The first gave an account of the sanitary movement abroad; the second described the sanitary movement at home; then followed the plan proposed, which was described in fifty sections. After that, seven reasons were given why the plan should be adopted, and ten possible objections were answered. Finally, a closing appeal was made to physicians, to clergymen, to educated men, to the wealthy and philanthropic, to the people, to the periodical press, to cities and towns, and to the state. The Commission submitted a bill to carry the plan into effect, but both it and the report were promptly laid on the table. It is doubtful if a more orderly report was ever presented to the Legislature.

Schedule of Sanitary Laws

The main part of the report covers about two hundred pages. Not the least valuable portions of the report were the thirty-two appendices which filled the remainder of the volume — some two hundred pages. These contained the results of sanitary surveys of Lawrence, Attleborough, Plympton, and Lynn, which were made by the Commission. The places were evidently typical, selected for purposes of illustration. The report also contained a list of the sanitary acts passed by the state, the text of the Great Sanitary Act of 1797, the Revised Statutes relating to Public Health (1837), sanitary by-laws and ordinances of Boston, communications, abstracts of scientific articles on housing, schedules of various kinds to be used for recording vital statistics, and a bibliography of sanitary books. And all this as the result of an expenditure of five hundred dollars, the amount appropriated by the state for the work of the Commission!

Shattuck's report pictured an ideal. The state was not ready for it at the time, but in later years most of his plan has been adopted, not only by Massachusetts but by other states.

In reading the report, one omission will be found conspicuous; there was no reference to bacteriological science; for this was long before the days of Pasteur. All the more remarkable, therefore, were the plans presented. Without a knowledge of the germ theory, Shattuck had an abiding faith in preventive medicine. Perhaps after scientists have pushed bacteriological methods to their natural or economical limit, they will turn back to the simple and fundamental principles of sanitation so will set forth in this classic report.

It is not altogether surprising that Shattuck's plan was not immediately adopted at that time. There were other and momentous issues before the people — chief among them that of slavery. And it would be untrue to give the idea that the physicians of the state did not themselves endeavor to secure legislation for state health control. Their efforts were invaluable. Many individual physicians did much for the cause, and without their aid legislation would never have been secured. In particular, the influence of Dr. Edward Jarvis should be recorded.

Attempts to secure Legislation

The early attempts at legislation were directed toward the establishment of a Board of Health and Vital Statistics.

In 1853 the Massachusetts Medical Society petitioned for the appointment of a "General Board of Health," but a joint special committee appointed to consider the matter failed to recommend it.[1] In 1861 a committee of the Boston Sanitary Association, consisting of Dr. Edward Jarvis, Josiah Quincy, Jr., and Josiah Curtis, presented a long memorial to the Legislature,[2] in which they asked for the establishment

[1] House Documents, 50, 1883.

[2] *Ibid.*, 112, 1861.

of a " Board of Health and Vital Statistics," which shall look after the vital and sanitary interests of the commonwealth. This memorial contains an estimate that among the people of Massachusetts between the ages of 15 and 70, the average loss of working time because of sickness was 8.82 days per year—varying from about 5 days, at the age of 15–20, to 10, at the age of 50–55, and 40, at the age of 65–70. The Massachusetts Medical Society and the American Statistical Association also sent in petitions the same year. The joint special commission this time recommended, approved, and drafted an act creating a Board of Vital Statistics, but it failed to pass.[1]

In 1862, Governor Andrew, in his inaugural, again took up the question, but a joint special committee reported " inexpedient to pass," a minority presenting a separate report favoring the idea. No action was taken that year.[2]

Finally, in 1869, a joint special committee reported that a bill establishing a State Board of Health ought to pass. This time no mention was made of vital statistics.[3] Evidently the time was now ripe for action, and the bill of establishment was passed on June 21, 1869.

The Harvard Medical School

The Harvard Medical School was founded, September 19, 1782. In November of that year, Dr. John Warren was elected Professor of Anatomy and Surgery, the first of that long and honorable list of Bostonians who have made the Faculty of the Medical School famous. He was the younger brother of Dr. Joseph Warren, the patriot, who fell at Bunker Hill. History relates that General Washington, on arriving at Cambridge, July 3, 1775, immediately instituted a medical board for the purpose of examining candidates for appointment in the medical department. Dr. Warren became a surgeon, and served in the continental army, along

[1] Senate Documents, 127, 1861.
[2] *Ibid.*, 82, 1862.
[3] *Ibid.*, 340, 1869.

with four other Harvard men. The next appointment was that of Dr. Benjamin Waterhouse, chosen in December, 1782, as Professor of the Theory and Practice of Physic. In May, 1783, Aaron Dexter, who had been one of the first to consider the founding of the Massachusetts Humane Society, was selected Professor of Chemistry and Materia Medica. These professors were inducted into office with much ceremony, on October 7, 1783.

Dr. John Warren

John Warren may be justly considered as the founder of the Harvard Medical School. He also founded a smallpox hospital, was associated with the American Academy of Arts and Sciences, which was established May 5, 1780, and was one of the founders of the Massachusetts Medical Society, and its president from 1804 until his death in 1815. Dr. James Jackson, writing his eulogy, said of him, " Science and humanity will delight in dwelling on his name, and his memory will long be cherished by the community." Thus we see that, at the very beginning, the Harvard Medical School was associated with public health matters in various ways.

The first home of the Harvard Medical School was old Harvard Hall in Cambridge. About 1787, Holden Chapel was fitted up for the accommodation of Professor Dexter and his associates. Later, the Alms House on Leverett Street, Boston, was used for a part of the work; the Marine Hospital in Charlestown, established in 1803, the Boston dispensary, founded 1805, and the State Prison at Charlestown, erected in 1805, offering the necessary clinical facilities. These early years were but beginnings, and it was not until 1811 that a strong department of medicine, known as the Faculty of Medicine, was established in the University.

In 1810 the Medicial School moved to Boston, with rooms in White's Building, on what is now Washington Street. In 1816 it had a building of its own on Mason Street, which was

used until 1846 when a new building was erected on North Grove Street, on land donated by Mr. George Parkman.

President Eliot revolutionizes Medical Education

Charles William Eliot became President of Harvard University on May 19, 1869. From his first attendance of the meetings of the Medical Faculty in that year there must be reckoned a remarkable advance in American medical education. For some years medical education in America had been going in a bad way. In Massachusetts, the State Medical Society and the Harvard Medical School had clashed on the question of the educational qualifications of those seeking to practice medicine in the state. It would be out of place to refer to these matters in detail, but the important influence of President Eliot at this time cannot be overlooked. On April 3, 1870, Dr. Oliver Wendell Holmes wrote to Motley, the historian, as follows:

> Another sensation is our new Harvard College President. . . . Mr. Eliot makes the Corporation meet twice a month instead of once. He comes to the meeting of every Faculty, ours among the rest, and keeps us up to eleven and twelve o'clock at night discussing new arrangements. . . . I cannot help being amused at some of the scenes we have in our Medical Faculty — this cool, grave young man proposing in the calmest way to turn everything topsy-turvy, taking the reins into his hands and driving as if he were the first man that ever sat on the box. . . .
>
> The other day one of our number said, " How is it, I should like to ask, that this Faculty has gone on for eighty years managing its own affairs and doing it well, and now, within three or four months, it is proposed to change all our modes of carrying on the School ? It seems to me very extraordinary, and I should like to know how it happens." " I can answer Dr. ——'s question very easily," said the bland, grave young man. " There is a new President." The tranquil assurance of this answer had an effect such as I hardly ever knew produced by the most eloquent sentences I ever heard uttered. . . . I have great hopes of President Eliot's energy and devotion to his business. . . . The whole University has been turned over like a flapjack. The Corporation has taken the whole management out of our hands, and changed everything. We are paid salaries (instead of fees), which I

rather like, though I doubt if we gain in pocket by it. We have, partly in consequence of outside pressure, remodeled our whole course of instruction. Consequently we have a smaller class, and better students, each of whom pays more than under the old plan of management.

It is worthy of notice that this renaissance in the Medical School began during the very year when the Massachusetts State Board of Health was founded, and one may readily believe that the enthusiasm of President Eliot in the Medical School, and throughout the University, communicated itself to his associates who served as members of the State Board of Health.

In December, 1883, the Medical School moved into its new building on Boylston Street, corner of Exeter Street, now occupied by Boston University. This building was the home of the School until the present magnificent buildings were established in Brookline in 1905.

Massachusetts Institute of Technology

The Massachusetts Institute of Technology has also been an important factor in the field of the public health of the state. The foundation of the Institute was laid in a "memorial," prepared in 1859, by William Barton Rogers, and presented by a committee to the legislature of 1860. On April 10, 1861, an act was passed by the General Court of Massachusetts to incorporate the Massachusetts Institute of Technology, "for the purpose of instituting and maintaining a society of arts, a museum of arts, and a school of industrial science, and aiding generally by suitable means the advancement, development, and practical application of science in connection with arts, agriculture, manufactures, and commerce." By the time the State Board of Health was established in 1869, there were members in the Faculty able to be of assistance to the state in its new public health movement. William Ripley Nichols, Professor of Chemistry, did some of his best research work in the interest of the state, and after him came a long line of chemists and biologists,

notable among whom were Dr. Thomas M. Drown and Professor William T. Sedgwick. In addition to the services rendered by instructors, many of the engineers, chemists, and biologists employed by the State Board of Health have been graduates of the Institute of Technology. For many years the state laboratories were located in the Institute buildings, and in other ways the co-operation has been intimate and highly beneficial both to the Institute and to the state.

Harvard College

It goes without saying that Harvard University, with its history dating from colonial times, has been a potent factor in the State Public Health movement. From the earliest days Harvard professors have served the state. Some of its presidents were doctors of medicine and connected with the local Board of Health. At the present time the State Antitoxin Laboratories are located in buildings owned by the University. The cordial relations between Harvard University and the state have done much to protect and improve the health of the people of Massachusetts.

CHAPTER II

BEGINNINGS OF THE STATE BOARD OF HEALTH (1869–1879)

THE Act creating the State Board of Health was passed on June 21, 1869. On July 31st of the same year, Governor William Claflin, with the advice and consent of the council, appointed as members of the board:

HENRY I. BOWDITCH, of Boston,	for seven years.
GEORGE DERBY, of Boston,	for six years.
P. EMORY ALDRICH, of Worcester,	for five years.
WILLIAM C. CHAPIN, of Lawrence,	for four years.
WARREN SAWYER, of Boston,	for three years.
RICHARD FROTHINGHAM, of Charlestown,	for two years.
ROBERT T. DAVIS, of Fall River,	for one year.

Of these, three were physicians, one a lawyer, one a civil engineer, one an historian, and one a business man.

The State Board of Health organized

The first meeting of the Board was held at the State House, September 15, 1869. On this occasion, the senior member, Dr. Bowditch, made an address in which he exalted the idea of "State Medicine," told of its recent development in England, and outlined its prospects in Massachusetts. No one can read this address [1] without feeling that the ideals of Lemuel Shattuck were about to be realized. One week later, the Board met again, adopted by-laws and chose Dr. Henry I. Bowditch as Chairman and Dr. George Derby as Secretary. It was decided to hold quarterly meetings at the State House. At first the Board had no home, the meetings being held in a committee room at the State House; and the Secretary's work was carried on at Dr. Derby's private

[1] It will be found in the second volume.

office in his own house. From such small beginnings has developed the present extensive organization, with its varied departments, its extensive laboratories and experiment stations, and with its branches extending over the entire state.

Very nearly the first thing that the Board did was to outline certain principles of action, and scatter them broadcast throughout the state. A circular[1] was mailed to the Mayor and Board of Health of every city, to the Selectmen of every town, to every member of the Legislature, and to every clergyman and physician in Massachusetts. This was a veritable declaration of rights as regards the public health:

A Bill of Rights in Public Health

WE BELIEVE THAT ALL CITIZENS HAVE AN INHERENT RIGHT TO THE ENJOYMENT OF PURE AND UNCONTAMINATED AIR AND WATER AND SOIL; THAT THIS RIGHT SHOULD BE REGARDED AS BELONGING TO THE WHOLE COMMUNITY; AND THAT NO ONE SHOULD BE ALLOWED TO TRESPASS UPON IT BY HIS CARELESSNESS OR HIS AVARICE OR EVEN BY HIS IGNORANCE.

And in the first annual report we read:

No board of health, if it rightly perform its duty, can separate the physical from the moral and intellectual natures of man. These three qualities of man are really indissoluble, and mutually act and react upon each other. Any influence exerted to the injury of one, inevitably, though perhaps very indirectly, injures another. As in the physical world there is a correlation of forces, so that no force is ever lost, but only interchanged with another, so do these various powers and qualities of man act upon each other, and act and are acted on by the physical forces of nature that surround him.

By the careful and comprehensive study of these various laws and of their relations, the highest department of the physician's art is brought into operation. But no man or private body of men has the ability to study and to develop this department as a free Commonwealth can do when acting through the agency of a few persons who are devoted to the object, and who come willingly to the work, and armed with the power and the ample means of the State.

[1] Reprinted in the second volume.

As to the methods, the general circular set forth the principles which have long been considered as characteristic of the State Board of Health of Massachusetts, namely, advisory rather than executive functions, and co-operation with local boards of health. To be sure, the Board gradually acquired executive functions, but generally speaking, more has been accomplished by educational methods than by compulsion.

The act of establishment defined the duties of the Board thus:

Statutory Duties

The board shall take cognizance of the interests of health and life among the citizens of this Commonwealth. They shall make sanitary investigations and inquiries in respect to the people, the causes of disease, and especially of epidemics, and the sources of mortality and the effects of localities, employments, conditions and circumstances on the public health; and they shall gather such information in respect to those matters as they may deem proper, for diffusion among the people. They shall advise the government in regard to the location of any public institutions. They shall, in the month of January, make report to the Legislature of their doings, investigations and discoveries during the year ending December thirty-first, with such suggestions as to legislative action as they may deem necessary.

Besides these general duties, the Legislature, in this act, described two specific duties. The Board was directed, first, to advise the government in regard to the location of any public institutions, and second — and this today is of special interest — to examine into, and report what, in their best judgment, is the effect of the use of intoxicating liquor as a beverage upon the industry, prosperity, happiness, health, and lives of the citizens of the state, and, also, what additional legislation, if any, is necessary in the premises.

As we proceed it will be interesting to follow the expanding functions of the Board, because successive legislatures have been constantly adding to them by the passage of special acts. A list of these acts, so far as they are pub-

lished in the annual reports and monthly bulletins, is given in the second volume.

First Work of the State Board of Health

Although an idealist, the Chairman of the Board was not devoid of practical sense, so that it was not long before several definite investigations were under way. The subjects chosen were not such as today would be regarded as of primary importance; but it must be remembered that in 1869, the world had no adequate knowledge of the nature and means of transmission of communicable diseases, and these diseases had not come to dominate our ideas of public health as they now do. The questions considered were nevertheless important — quite as important, perhaps, as our present bacteriological problems. One of them was the use of intoxicating liquors, which was especially mentioned in the act creating the Board; the other three were all prominent — and even pressing problems at the time — the control of the business of slaughtering, the sale of poisons, and the effect of improper housing on sickness and death among the poor.

In addition to this work outlined by the Board, other subjects soon came up for consideration. Complaints were made by citizens of the state as to the influence of mill ponds on health, the pollution of streams by tanneries, the sanitary conditions of " lock-ups," and so on. All of these matters were made the subject of recommendation by the secretary. In some cases, where there were disputes between individuals as to sanitary matters, the secretary acted as an impartial judge, and helped to settle affairs out of court.

It will be profitable to consider a few of the topics discussed in the early days, in order that comparisons may be made with later work. We cannot consider them all, but any one who is interested may find abstracts of the various scientific papers and reports in the second volume.

Slaughter-Houses

One of the first tasks undertaken was an investigation of the processes used in preparing meat for the market and the

disposal of fats and animal refuse. The conditions were bad, especially in Brighton. Slaughter-houses were numerous, unsanitary, and conducted without system. They were without drainage, and surrounded by filth which spread revolting odors over whole neighborhoods. To the odors of decomposition were added those of fat-melting, bone-boiling, and the boiling of dead horses in open vats. Another disgusting and unsafe practice was that of feeding waste from the slaughter-houses, entrails of animals, and the like, to hogs, which were kept beneath the buildings and eventually used for food. The Board pointed out the objectionable character of these methods, and showed how the butchers were not only creating nuisances, but wasting valuable substances which could be recovered and sold; yet it was more than a year before anything was accomplished, the butchers regarding the reforms as impracticable. An act was passed in June, 1870, authorizing the incorporation of a Butchers' Slaughtering and Melting Association, but not a dollar would the butchers subscribe to such a project. Consequently the Legislature passed another act in April, 1871, which gave the Board the power " to order persons carrying on offensive trades to desist and cease from carrying on such trades if, after a hearing, it was the judgment of the Board that the public health or the public comfort and convenience required." Fines were provided for, and the courts were directed to enforce the order of the Board. This brought results. A conference was held at the State House in May, which was largely attented by butchers and other interested persons. The butchers outlined minor reforms, but these the Board deemed insufficient. More complaints came in, and, under the new law, legal proceedings were instituted. It became evident that the Board was in earnest, and one result of this was the organization of the Butchers' Slaughtering and Melting Association, which had been authorized in

Improvements in Slaughtering

1870, but ignored. This was regarded as a definite step in advance.

The Brighton abattoir was completed and put into use in June, 1873. An interesting description of it is given in the annual report of the Board for 1874. Sanitary regulations were adopted by the Board in October, 1873. This brought up another problem, namely, the need of an inspector. Soon, however, Brighton was annexed to Boston and, in 1875, the State Board asked to have the oversight of the abattoir transferred to the City Board of Health, which was done in June, 1876.

An important Case

Meantime other slaughter-houses in the suburbs of Boston were causing complaint, and for several years the Board gave considerable attention to these subjects. An important case, from the legal standpoint, occurred in Watertown, and is described in the annual report of 1879. George A. Sawyer, who maintained a slaughter-house, was directed by the Board to abate certain nuisances by making certain modifications in the plant, but did not do so. There was some question as to the power of the Board, under the statute, to regulate noxious and offensive trades, one view being that the Board had the right to suppress, but not to regulate. Sawyer was ordered to cease, and desist from business, but he refused. Whereupon the case was tried, and the Superior Court, in a decision upheld by the Supreme Court, gave Sawyer permission to continue business, but made him comply substantially with the regulations of the Board.

The annual report of 1875 contains scientific articles on the "Transportation of Live Stock," by J. C. Hoadley, C.E., and the "Relation between Meat Supply and the Public Health," by Dr. Charles F. Folsom, the Secretary of the Board.

From 1879 to 1914, the annual reports make occasional mention of slaughtering. During a part of this period, the Cattle Bureau of the State Board of Agriculture had control;

but in April, 1911, the powers of the Cattle Bureau were transferred to the State Board of Health. At the present time the meat supply of the state is very much inspected by federal, state, and municipal authorities — in fact, the business is perhaps too much regulated.

Intoxicating Liquors

In compliance with the duties of the Board as laid down by the Legislature, a study of the use of intoxicating liquors was made. The annual report of 1871 contains the replies of one hundred and sixty-four physicians to the question, " What, in your judgment, has been the effect of the use of intoxicating liquor as a beverage upon the health and lives of the people in your town, or in the region in which you practice ? " Of these forty-eight said " very destructive "; forty-nine said " injurious, to a greater or less degree "; sixteen said " habit not affected "; the rest gave replies not easily classified.

In the annual report of 1872 is printed an important paper on this subject by Dr. Henry I. Bowditch, the Chairman of the Board, in which he attempts to show the fundamental relations between intemperance and isothermal lines, race, nature of the stimulant, and the culture of the grape. Those interested in this subject should consult the original paper, a summary of which will be found in the second volume. Dr. Bowditch's idea in associating intemperance with cosmic laws has been regarded as original with him. Although printing the report, the Board expressed no opinion upon the subject, other than to approve the idea of establishing asylums for inebriate persons. Admitting that legislation was needed, Dr. Bowditch, in 1875, discussed the difference between vicious and moral drunkenness, and suggested a method of treatment in asylums. He regarded this as a hygienic measure of the highest importance.

Again in the following year, the Board printed another discussion of the subject by Honorable P. Emory Aldrich, a

member of the Board, but took no official action. Since that year, the subject seems to have been dropped, except for a brief mention of intemperance in the report of 1879, and a few references to it in later reports. In 1902, the Legislature abolished the office of inspector and assayer of liquors, transferring their duties to the State Board of Health.

Improper Housing

The housing problem appears to be an ever present one. From the earliest period of sanitation to this day of city planning, earnest men and women have given thought to the question; but it yet awaits solution, and perhaps will never be solved. Yet we ought not to be discouraged. Progress must necessarily be slow, because structures representing a large investment, hedged about with legal restrictions and property rights, and built of materials capable of lasting for years, cannot be expected either to give way or be altered rapidly. The problem, too, is many sided — ignorance, poverty, economic conditions, human greed, political corruption must all be reckoned with. As one studies the history of the subject, he is struck with the fact that each generation, acting through groups of interested persons — now here and now there — has attacked one little corner of the question, leaving the others untouched. But on the whole, this constant hammering has had its effect — housing is improving. In many ways, the dwellings of the poor as well as those of the rich are more comfortable than formerly, and, if there is a difference, it may be said that the dwellings of the poor have gained in comfort and healthfulness relatively faster than those of the rich. The problems of congested buildings and areas and the problems of house sanitation are still with us, and each new discovery of sanitary science shows us how much there is left to be done. Let us now see what part the State Board of Health has played in this field. Mention is made of the subject in the first report of the Board. The leveling of Fort Hill in Boston threw large numbers of poor

people out of their homes, and made cheap housing an imperative need. In 1870 the Secretary addressed a letter on the subject to the Boston Board of Aldermen, but it was wholly without effect. Meantime, the chairman was studying the problem in London, and the annual report of 1871 contains a long letter from him, which deals largely with it.

In 1871, the Boston Co-operative Building Company was formed, with the object of acquiring land and buildings to be rented to the poor, so as to provide cheap and sanitary houses for them. It made a fair beginning, and among other things, hired the " Crystal Palace " in Boston, a notorious rookery, and changed it into a " model tenement." This work was heartily commended by the Board in its annual report of 1872.

The annual report of 1873 contains a long paper by Dr. Frank W. Draper, embracing the results of a personal investigation of the housing conditions in the largest cities of the state. Referring to this study, the Board says: " We have in fact among us, and rife, all the elements of the lowest barbarism, in which men and animals lie down together in filthy abodes. And although this barbarism at present clings to a small portion of the community, it will be found to taint with its impurities a large area occupied by a better and more civilized class." The Board also chided municipal authorities for being neglectful; at that time, apparently, they regarded the problem as one for local solution.

Air and Ventilation

Akin to the subject of bad housing is that of bad ventilation, and naturally, therefore, we find this topic discussed. In the annual report of 1871 there is a paper by A. C. Martin, an architect of Boston, on the ventilation of schoolhouses. He refers to the prevailing idea that exhaled carbonic acid is the chief cause of the vitiation of the air in crowded rooms, rejecting this explanation as insufficient, and holding that *watery vapor* and the animal matter given off by the lungs

and skin are of greater significance. Carbonic acid he regarded as an obstructor of respiration, not as a poison. "No surer or more exact test than a well educated nose has, as yet, been discovered to measure the amount of vitiating animal matter thrown into the air." Some of these ideas have been recently set forth as modern. Again, Mr. Martin advocated the use of many local inlets and outlets close to the individual desks. Scientists have recently experimented with a similar arrangement. Surely "there is nothing new under the sun." There should be no disparagement of modern rediscoveries, however, — they are quite normal. A given point on a wagon wheel rises to the top many times as it revolves, but the essential thing is that the wheel moves forward. Some wheels, however, turn without advancing. Sanitarians may well ask the question whether the art of ventilation resembles one wheel or the other.

In the same report there is another paper on "Air and Some of its Impurities," which contains many points of scientific interest, such as studies of carbonic acid, dust, and iron in the dust. Best of all, however, is the following amusing commentary in the Secretary's abstract of the paper. He says, "Although the microscopical investigations teach us but little relative to the germ theory of disease, they do us substantial service when they tend to check the exuberant imaginations of many about 'organic germs,' of which we have heard so much during the past year." In the annual report for 1888, however, we find a very elaborate treatise on micro-organisms in the air of the Boston City Hospital. Within the interval a great change had taken place.

Micro-organisms in the Air

In the annual report of 1875, there is a discussion of the ventilation of railroad cars, and in that for 1887 the ventilation of schoolhouses is again considered. An important study of hospital ventilation was made by Dr. Edward S. Wood, of the Harvard Medical School. His report, published in

1878, contains many interesting diagrams of air currents in different parts of the rooms and around the cots.

Water Supplies, Stream Pollution and Sewerage

Public water supplies and the condition of the inland waterways have always received much attention in Massachusetts; in fact, it has been largely for its investigations of water supplies and methods of sewage disposal that the Board of Health has acquired fame beyond the borders of the state. Of all the annual reports which have been published during these forty-five years there is hardly one in which these subjects are not treated in one way or another. At first, we find various topics discussed; but little by little, an increasing regularity in the study of the water supplies of the state is observable, until in 1886, the Board began the systematic researches which have been kept up to this day.

The first scientist to be employed by the Board was Professor William Ripley Nichols, of the Massachusetts Institute of Technology, whose earliest official communication is found in the annual report of 1871. It treated of lead poisoning, a subject which had long interested English chemists, and had become a serious question in several towns of the state. In the same annual report is another contribution by Professor Nichols, giving the results of examinations of the water of Mystic Pond, and the supply of Charlestown and several cities north of Boston. The knowledge of water analysis was then in its infancy. The report shows that the tests used were few and crude. The young chemist, twenty-four years of age at the time, threw himself into the work with great enthusiasm. He studied the progress of the subject in Europe, and experimented for himself, thus becoming master of his subject; for more than fifteen years his influence was strong in the counsels of the Board. He it was who laid the foundations of the future work in this field.

In 1872 the Legislature requested the State Board of Health to investigate the general problem of stream pollu-

tion. Professor Nichols was sent to England to learn the latest developments in the methods of disposing of sewage and protecting streams from pollution. His report, in 1873, was thorough. A comparison between it and the report written two years before shows that the art of water analysis had improved, for we now find the terms "albuminoid ammonia and free ammonia" used, while the tests for nitrites and nitrates were no longer qualitative, but quantitative. In particular, studies were made of the pollution of the Blackstone River at Worcester and the Merrimack River at Lowell. In this investigation, he was assisted by Miss Ellen H. Swallow, better known in later years as Mrs. Ellen H. Richards, a name justly famous in the annals of American sanitation.

The Work of William Ripley Nichols

In the annual report of 1874 we find a continuation of his studies of water supplies and streams, and, in fact, for many years he continued his analytical work, sometimes being called upon to make special reports, and often assisting in the investigations of others. It was in 1878, however, that he published his celebrated report on the Filtration of Potable Water, which became the basis of his own book on Water Supply, a few years later. This report so well exhibits the state of the art of filtration in those days that a portion of it is reprinted in the second volume. In 1879, he made a study of the temperature of water at different depths in reservoirs, together with the effect of temperature changes upon the quality of the water. This was probably the first study of the phenomena of stagnation in American water supplies.

But Nichols was by no means the only expert employed by the Board. We find in the early reports the names of some of the leading engineers of the times. In 1873, Phineas Ball studied the possibility of utilizing the sewage of Worcester. James P. Kirkwood made extensive investigations of stream

pollution in 1876, and in the report of the same year, Dr. Frederick Winsor published an article on the sanitary aspects of these questions. Edward S. Philbrook described the effects of House Drainage in 1876, while in the report of 1877, E. S. Chesborough had an interesting article on the general subject of sewerage. In 1879, Eliot C. Clarke, the engineer of the Boston Main Drainage system, gave a very good description of some of the old sewers of Boston.

Early Studies of Sewage Disposal

Dr. Charles F. Folsom, who succeeded Dr. Derby as Secretary of the Board, also took a keen interest in the subject of sewerage, and studied the subject abroad. Important contributions by him are found in the annual reports of 1876 and 1877. They give an excellent picture of the state of knowledge and methods at that time. Especial attention should be called to the annual report of 1876, a thick volume devoted very largely to water supply and sewerage matters.

On April 26, 1878, the Legislature passed an act relating to the pollution of streams, in which the general supervision of all rivers, streams, and ponds used for public water supplies was committed to the State Board of Health. This was an important measure, which we shall have occasion to refer to later.

An important Pollution Case

Mention should also be made of the famous case of Cambridge *vs.* Niles Brothers, the facts and testimony in regard to which are given at length in the annual report of 1879. The defendants had begun the construction of a slaughter-house on the watershed of Fresh Pond, the supply of Cambridge, and the city naturally objected. It was finally built under permit of the town of Belmont, in which it was located, and, until 1881, was operated under the supervision of the Board. Professor Nichols at this time made studies of the best methods of treating the wastes. In 1881 this portion of Belmont was annexed to Cambridge, which change gave the latter city authority to abate the nuisance.

Miller's River Commission

In 1872 a Joint Commission, consisting of the Board of Harbor Commissioners and the State Board of Health, was created to devise a plan to eliminate the nuisance existing in the lower basin of Miller's River, a small tributary of the Charles River between Cambridge and Somerville. The stream had become seriously contaminated by sewage and obstructed by packing-house refuse. Phineas Ball of Worcester was made the Engineer, and his report, published in the report of the Harbor Commissioners, recommending changes in the sewerage systems, was accepted. The works were not constructed exactly as he suggested, but in the course of a few years the nuisance was largely eliminated. This event is important, historically, as it was the first of a series of those co-operative investigations in which the State Board of Health has taken a leading part, to the great benefit of the Commonwealth.

Metropolitan Sewerage for Boston

At the same time the Board called the attention of the Legislature to the need of studying a project of drainage for the entire Metropolitan District. The success of the Joint Commission in solving a problem which neither Cambridge nor Somerville had been able to solve alone was given as an example of what might be accomplished. It seems that the year before (1872), the Legislature had passed an act providing for a commission of engineers to report plans for the sewerage and water supply of the Metropolitan District, but it failed to become operative because the City of Boston declined to join in the project, on the ground that the neighboring cities and towns were not to share the expense. This recommendation for the study of the sewerage of the Metropolitan District was urged again in 1873, and in the report of 1874 further reference is made to dangerous conditions due to deposits of sewage sludge on mud flats.

On December 28, 1874, the Boston Board of Health urged the City Council to take up the matter, and as a result, an

order was passed on March 1, 1875, authorizing the Mayor to appoint a commission, two engineers and a person skilled in sanitary science, charged with the duty of preparing a plan for outlets and main lines of sewers for the future wants of the city. E. S. Chesborough, C.E., Moses Lane, C.E., and Charles F. Folsom, M.D., were selected. Their work was well done, and as a result the Legislature, on April 11, 1876, authorized the City of Boston " to lay and maintain a main sewer discharging at Moon Island in Boston Harbor, and for other purposes." The City Engineer, Joseph P. Davis, was placed in charge of the work. Eliot C. Clarke, his principal assistant, has described the events which led up to this project and the engineering works themselves in a valuable report published by the city in 1885, entitled " Main Drainage Works of the City of Boston." It is one of the classic reports of American engineering.

The Days before Pasteur

Three articles in the early reports indicate that the germ theory of disease had not become even a working hypothesis, notwithstanding there were many " exuberant imaginations about organic germs," to quote the words of Dr. Derby again. The first of these articles, in 1871, was on the causes of typhoid fever. It was evident that Pettenkofer's soil theory, which had held the stage for some years, was giving way to the English idea that typhoid fever was conveyed in water and caused by animal excrement; what was meant, however, was not bacterial infection, but the decomposition of organic matter. The second article was by Professor Nichols, in 1875, on the Composition of the Air of the Ground Atmosphere. Still influenced by Pettenkofer, people feared air which contained organic emanations, and in the newly filled land of the Back Bay district there was a possibility that danger was lurking in the soil. Nichols gave this " ground air " a clean bill of health. The third paper, in 1877, was by Dr. Charles F. Folsom on the Effects of Bad Drainage on

The Wanklyn-Frankland Controversy

Health. He told about the now almost forgotten disputes between Wanklyn and Frankland in England, the former holding that the contagion of water borne diseases was of an albuminoid character and subject to removal by filtration, the latter belonging to the "purist" school, which held that all sewage polluted streams should be abandoned as water supplies, even the Thames River supply of London. We now know that both were partly right and partly wrong. Another controversy was mentioned, this time in Germany, between Virchow and Pettenkofer himself, as to the truth of the latter's theory that the chief agency in the spread of typhoid fever and cholera was the decomposition of organic matter in the soil, variations in the level of ground water causing the gases to escape into the air. It was not many years, however, before the germ theory of disease was established, after which important developments followed. Massachusetts, like the rest of the world, owes much to Louis Pasteur, and Boston has done well to name the broad avenue which leads from the Harvard Medical School toward the heart of the city Louis Pasteur Avenue.

Industrial Conditions

Industrial conditions were first considered in the annual report of 1871, in a paper containing statistics as to the health of minors employed in textile factories. The use of the sewing machine operated by foot power gave rise to a heated discussion, and accordingly we find the subject treated in 1872, in a paper by Dr. Arthur H. Nichols. He came to the conclusion that moderate use of the machine was not injurious to women, but that long continued use might be. He recommended better treadles and the substitution of some other motive power where possible.

In 1874 the health of the farmer was considered, and unsanitary farmhouses and unhealthful modes of living in the country were discussed.

Food Studies

The keeping of acid fruits in tin cans was studied by Henry B. Hill, at Harvard University in 1871. A little later, flavor-

ing articles were studied, but the first comprehensive study of the food problem was that of Dr. George Derby, an abstract of which may be found in the second volume. It contained interesting allusions to the domestic conditions of the times. For example, he said that " the wages of domestic servants were increasing; home life was being discouraged; people were taking refuge in hotels and boarding houses; women were leaving home life for the factory; the pressure of town life was increasing." Again, speaking of the custom of rapid eating, he said, " The usual or average time occupied in the process of taking food by the people of this state we think does not exceed from twelve to fifteen minutes for each meal."

The Domestic Problem

In the same year, 1873, we find the first mention made of the adulteration of milk, a matter which has received much attention at the hands of the Board in later years. And it is interesting to find as one of the authors of the paper the name of Professor James F. Babcock, whose apparatus for determining fats — the Babcock testing machine — has become a household word among farmers and milk chemists.

The sale of poisons was discussed, in a general way, in the very first report of the Board. Arsenic in artificial coloring substances, used on artificial flowers, wall paper, etc., was considered at length in 1872, and the public was especially warned again the use of green paper, and in fact against almost everything green — grass and trees excepted. The opium habit was considered in 1872.

Poisons

Very naturally the study of particular diseases and their prevalence received early attention, and curiously, but perhaps naturally, some of the least common diseases were taken up first. In the reports of 1871 and 1879, there are papers on trichinosis and charbon, or malignant pustule; in 1871, on the foot and mouth disease; in 1874, on cerebrospinal meningitis; in 1878, on scarlet fever and yellow fever. Small-

Study of Diseases

pox and vaccination were discussed in every report from 1871 to 1874, and again from 1888 to 1904. Of especial interest is the article printed in the report of 1872, because a severe outbreak of this disease occurred the following year.

Soil Dampness and Consumption

Dr. Bowditch was considered an authority on consumption, and held radical views as to the conditions which caused the spread of this disease, namely, that consumption was directly associated with dampness of soil. In 1872 he sent letters of inquiry to many physicians, and his analysis of the results is given in the report of the following year. Two hundred and five out of the two hundred and ten physicians who replied stated that the disease was caused or promoted by hereditary influences, and from this Dr. Bowditch did not hestitate to conclude that the state should restrain marriages of persons liable to breed consumption. "Massachusetts has yet much to do in stirpiculture ere she can claim to be really a mother to her people." Modern believers in eugenics would enjoy reading his paper, although it is now known that heredity has less to do with the transmission of this disease than the doctors then thought. In spite of the fact that consumption long stood at the head of the list of diseases, no further study of it was made by the Board for many years.

Typhoid fever early received attention. In the annual report of 1871, there is a statistical study of the disease, with a discussion of the results, which in an interesting way reveals the then current ideas as to the spread of the disease.

Vital Statistics kept by the Secretary of State

At the time of the organization of the State Board of Health, the vital statistics of the state were being kept by the Secretary of State.[1] Acts relating to the registration of deaths were passed in 1872 (Chap. 275), in 1877 (Chap. 174), and in 1878 (Chap. 341). In 1878, an arrangement was made

[1] Chapter 21 of the General Statutes.

with the Secretary of State by which the State Board of Health should edit the registration report and co-operate with that office in securing accuracy and completeness of returns.

Two special articles relating to vital statistics appeared in the early reports. The first was that of Dr. F. W. Draper, of Boston, in 1876, on Registration of Prevalent Diseases. It contains some interesting curves of seasonal distribution of certain diseases, but these were of no great accuracy. The second, by Dr. Charles F. Folsom, in 1877, was a study of the accuracy — or rather the inaccuracy — of the returns of deaths in the state. The most interesting part of his paper is the history of the registration of deaths in Massachusetts. Some amusing causes of death are quoted from the returns of physicians, such as "death caused by five doctors," "delicate from birth," "direars," "collocinphantum," "artery lung busted." The paper goes outside of Massachusetts, describing the practice of registration elsewhere in the United States, and in Holland and Germany.

Statistical Studies of Physique

Two papers on the Growth of Children were published by Dr. H. P. Bowditch, of the Harvard Medical School, in the annual reports of 1877 and 1879. They embodied the results of many carefully made observations on the weight and height of children in the Boston schools. Masterpieces of statistical work, these papers deserve careful study. The data are classified by age, sex, nationality, and occupation, and are clearly illustrated by many diagrams. The second of the two papers describes the anthropometrical methods used. Speaking of this work, Dr. Bowditch says:

> It will thus be seen that a wide field is open for statistical research, in which nearly everyone can do good work. The collection of physical data in regard to the human body has been, in the past, left almost exclusively in the hands of artists, who have sought to establish, as guides for their work, simple proportions between the various dimensions of the body, and of military statisticians, who have looked upon

the human frame simply as a machine for performing a soldier's work, and have necessarily confined their observations to adult males. It is to be hoped that in the future the hygienist and the educator will recognize, in the physical measurements of growing children, a guide for the application of their sanitary regulations and a test for the efficiency of their systems of physical training.

Sanitarians of today should heed these words.

In this connection should be mentioned a third paper by Dr. Bowditch, published in the annual report for 1889, on the "Physique of Women." This is of interest not only for the data given, but for the method of statistical analysis used, namely, Galton's method of percentile grades. In view of the recent interest in the study of probability, or the "laws of chance," in sanitation, this paper is one which should be consulted by students of vital statistics.

Infant Mortality

The report of 1873 contains a scholarly discussion of infant mortality by Dr. Edward Jarvis, who, like Lemuel Shattuck, was fond of statistics. His paper is strikingly modern in tone. The causes of infant mortality were stated in very much the same terms as they are stated today, emphasis being laid on the need of educating mothers, both before and after the birth of children. Modern social workers might well refer back to this paper, written so many years ago, in order to measure what progress has been made in forty years.

Relations between the State Board and Local Boards of Health

When the State Board of Health was established, there already existed many independent boards of health in cities and towns, which had been organized under Chapter 26 of the General Statutes, an act dating from 1849. The conditions under which they labored were described in 1874, by Dr. Azel Ames, Jr., in a paper which discussed the various regulations as they ordinarily existed — these forming a sort of sanitary code. The publication of a code, suggested by the State Board in 1873, tended to unify the regulations throughout the state. According to the law at that time, towns might appoint a board of health or a health officer, and, in the

event of failure to do so, the duty fell upon the Selectmen to act as a board of health. The only qualifications were that the members of the board of health should be "persons." In 1873 the State Board urged upon each town the advantage of appointing at least one physician to the local board of health, and evidently this advice was much needed. Of two hundred and seventy-nine towns, two hundred and sixty-two had boards of health composed of the Selectmen alone; in only six was a physician added to the number. At that time, the "persons" most competent for the positions were certainly physicians, many of whom took a keen interest in sanitary matters. Nowadays, we find that the subject of public health has become a specialty, and something apart from the work of the physician, although by no means more important. The physician's work is essentially personal; the work of the public health official has come to be largely communal.

Local Health Correspondents

Correspondents were chosen in the different cities and towns, who sent communications to the State Board of Health, and many of their statements were printed from year to year in the annual reports under the heading, Health of Towns. It soon became evident that the local boards were not doing their duty. They did not, however, realize the extent of their powers, which, in fact, were greater than those of the State Board. During the years 1874 to 1879, we find the State Board of Health spurring on local authorities, offering aid by issuing circulars, and giving advice in particular cases. In 1877 an act was passed (Chapter 133) providing for the establishment of boards of health in the several cities of the Commonwealth. This was adopted by Cambridge, Lowell, Worcester, New Bedford, Newburyport, Lawrence, Somerville, and Fall River. Some cities refused to adopt the act, while others ignored it. Consequently, the State Board of Health urged the passage of another act

giving the mayor and aldermen power to appoint a board of health, in case a city whose citizens had not accepted the act was threatened with an outbreak of disease.

In the last (tenth) report of the original State Board of Health, 1879, we find these words:

> Each year the work of the Board has increased very much in conferring with local boards as to their powers under the law, and in giving advice with regard to individual complaints, or sources of foul odors and ill health. As more and more towns organize boards of health there would naturally be more of such work to be done. Indeed, the Board, in the ten years of their existence, have as yet hardly been able to more than prepare the community to see the necessity of concerted action to prevent disease; and, in some form or other, that work must go on.

Economic Studies

Dr. Edward Jarvis presented a splendid discussion of public health in an article entitled, " The Political Economy of Health," published in the annual report of 1874. It was based on a text quoted from the distinguished sanitary engineer, Baldwin Latham: " Health is the capital of the laboring man." Again, in the 1875 report, we find another statistical and economic study by Dr. W. E. Boardman, entitled, " The Value of Health to the State."

A curious Idea regarding Mill Ponds

The early reports are not without their vagaries, just as some of the reports which we write today may seem to our grandchildren to be vagarious. In the 1872 report, Dr. Derby wrote against the practice of building storage reservoirs for power purposes, on the ground that they impede run-off and raise the level of the ground water, thereby causing consumption, and convert meadows into swamps, thereby causing typho-malarial fevers. He wrote:

> The hygienic effect of the building of dams is usually wholly ignored by capitalists and legislators. We here see the danger to life of proceeding thus blindly. Here are acts sufficient to convince any unprejudiced mind that consumption and malarious fevers are thus aroused. Epidemics flourish near such water obstructions. Great nuisances are

thus created in various places cited in this report. It will be seen that industrial and hygienic questions are inseparably joined, and it will be well that our legislature should so regard them when mill-dams are thought necessary to aid capital in its honorable endeavor to turn our various water-courses to the benefit of man.

Among the other subjects considered, during the early period of the Board, we find the following: Treatment of the Insane (1871), Cremation and Burial (1875), Defective House Drainage (1876 and 1879), Diseases of the Mind (1877), Cottage Hospitals (1874 and 1878), Color Blindness (1878), Sanitation of Schools (1878), The Hospital Home (1879).

State Medicine

It would not do to omit from this chapter Dr. Bowditch's letter to the Board on the subject of Preventive Medicine and the Physician of the Future, which, with some omissions, may be found on a later page. The term "State Medicine," used by Lemuel Shattuck, which was also in vogue at the time the State Board of Health was organized, gradually fell into disuse, and the term "Preventive Medicine" took its place. "Prevention is better than cure" became the watchword, and this maxim still rules the thought of today. Dr. Bowditch's letter lays great stress on personal hygiene, on housing, nutrition, clothing, exercise, bathing, education, and work. These topics are not all included in the reprinted portion of his letter, but they are well worth reading in the original report. They serve to show the broad-mindedness of the first leader of the State Board of Health.

The Period of Individual Effort

Looking back over the record of the State Board of Health from 1869 to 1879, one is struck with the simplicity of the organization, the important part played by the secretary of the board, and the importance of the work of certain individuals who undertook special investigations at the request of the Board. The reports and scientific papers which were published in the annual reports of those years and which we have just passed in review, taken together, are an excellent

portrayal of the ideas concerning sanitation then current. It was a time of awakening; the knowledge of sanitation was progressing in Europe, and Massachusetts was not slow in learning what was being done.

The first years were also years of self-scrutiny. The Massachusetts State Board of Health was studying Massachusetts, her people and their health, the diseases common among them, the sanitation of their homes, the nuisances to which they were subjected, the water they drank, the method of waste disposal, the ventilation of their schoolhouses, the disposal of their dead. The Board was "taking cognizance of the interests of health and life."

Questionnaire Method

It is worth while to observe how many of the published papers contain the results of data collected from the physicians of the towns and cities in answer to circular letters. In other words, the "questionnaire method" was vigorously applied, and it produced two very desirable results — it yielded the data wished for, and it made the local physicians interested in the work of the central authority. Nor was this "questionnaire method" conducted in a haphazard manner. As early as January, 1870, a circular letter was sent to every city and town asking that a medical correspondent be designated, in order that accurate and prompt information concerning the occurrence of disease might be obtained. Without doubt, this co-operative work was of value — co-operative work will always be of value, and it will be unfortunate if the friendly relations between state and local authorities are ever broken.

End of the Original Board

For reasons political, which need not be discussed, the original State Board of Health came to an end on June 30, 1879, and the State Board of Health, Lunacy, and Charity was formed. This was a great disappointment to Dr. Bowditch and his associates, for it rudely shattered the work so well begun; and although he and two others, Dr. Davis and

Mr. Hoadley, were retained as members of the new board, it was not long before they resigned.

During the ten years of its existence the State Board of Health had made a splendid record, and in many ways had justified its existence. Thoroughly and sincerely it had taken " cognizance of the interests of health and life " of the people; it had served as an important medium for the diffusion of the knowledge of hygiene and sanitation; had stimulated legislation; had aroused the local authorities to greater activity; had established a solid reputation; and had acquired the confidence of the state. Upon this solid foundation, the future State Board of Health was to build its noble structure.

CHAPTER III

THE BOARD OF HEALTH, LUNACY, AND CHARITY (1879–1886)

In 1879, the Legislature passed a law combining the previously existing boards of Health and Charities into what was called the State Board of Health, Lunacy, and Charity. This law took effect on July 1st; was amended in 1881; and in its final form went into effect February 1, 1882.[1] This bringing together of administrative boards, whose functions were more or less distinct, was not a logical step; it was merely a political change; and after a few years the misalliance was ended, divorce being granted on the ground of incompatibility.

Reorganization

The Board of Health, Lunacy, and Charity had nine members, whereas the original Board of Health had had seven. In order to perform its varied duties, it was found necessary to divide the board into committees, and to apportion the work among four departments. Three members of the former Board of Health, Messrs. Bowditch, Davis, and Hoadley, were retained as members of the new board and constituted a Committee on Health. Dr. Folsom, another member of the old board, was made secretary and executive officer of the new Department of Health.

During the summer of 1880, Dr. Folsom retired as secretary, and was made a member of the Board, only to resign early in the following year. Dr. Bowditch had already resigned to become a member of the National Board of Health, in 1879, and when he retired from this position in

[1] Public Statutes, Chaps. 79, 80, 87.

1881, Dr. Folsom succeeded him. On July 27, 1880, Dr. Henry P. Walcott of Cambridge was appointed Health Officer, and as such was given general executive charge of the public health work. Meantime, the Committee on Health of the Board of Health, Lunacy, and Charity had its membership increased from three to five. The other heads of departments were H. B. Wheelwright, of Newburyport, Superintendent of Outdoor Poor, S. C. Wrightington, of Fall River, Superintendent of Indoor Poor, and F. B. Sanborn, of Concord, Inspector of Charities. Dr. Henry P. Walcott resigned as Health Officer on December 2, 1882, and, one week later, became a member of the Board and Chairman of the Committee on Health. Dr. Samuel W. Abbott, of Wakefield, was appointed Health Officer in his place.

Dr. Walcott chosen Health Officer

In 1883, trouble occurred during the administration of Governor Benjamin F. Butler, in connection with the Tewksbury Almshouse and other matters. The State Board of Health, Lunacy, and Charity was naturally involved. There was internal disturbance, and it will be found that the annual report for that year was signed by only six members of the Board, the other three dissenting from some of the views expressed. The violent political attack on the Board did not relate to public health, and therefore is not mentioned here; it had best be forgotten. On March 26, 1886, the Legislature passed an act re-establishing the State Board of Health, with enlarged powers and duties, and separating it from the Board of Charity.

Another Reorganization

In spite of the unsettled condition of the Board during this period, the work went on unabated, and the scientific articles of those years, 1879 to 1885, contained in the Public Health Supplements, are no less interesting than those published in the earlier reports. Furthermore, during this period certain events occurred which led up to the remarkable development of the engineering work of the Board in later years.

Investigation of Stream Pollution

The investigations relating to the pollution of streams which had been begun in 1875 by James P. Kirkwood were continued until practically all of the state had been covered. In the annual report of 1876 we find the results of the sanitary surveys of the Blackstone, Neponset, Charles, Chicopee, and Taunton Rivers; in 1878, the Hoosic and Housatonic Rivers; in 1879 (Supplement), the Westfield and Merrimack Rivers; and in 1880 (Supplement), the Deerfield and Miller's Rivers. In 1879 (Supplement), Professor Nichols described an accidental discharge of sulphuric acid from a chemical factory into an inlet of Mystic Pond, and its effect on the water.

Study of Algae in Surface Waters

Algae in surface water supplies came to be regarded as a "problem" in 1879. In the Supplement to the first report of the State Board of Health, Lunacy, and Charity, we find three important articles on this subject. The first was by Professor Nichols, who described observations which he made at Fresh Pond as to the stagnation of the water resulting from thermal phenomena. The second was by Alphonse Fteley, the engineer who designed the Sudbury system of the Boston Water Works, telling of the growth of algae in the Sudbury reservoirs, particularly No. 3, and the filtration experiments which he had made with the hope of getting rid of the odors caused by the algae. These experiments brought no definite result. The third paper, most interesting of all, was by Dr. William G. Farlow, Professor of Cryptogamic Botany at Harvard University. He made a study of the Blue-green Algae, such as Anabaena, Nostoc, Clathrocystis, and Coelosphaerium, warning the public against being unduly alarmed by the presence of these microscopic plants with long names but no power to cause the many diseases at that time attributed to them. He gracefully suggested that it was not for the botanist, but for the physician and sanitarian to pass judgment as to the harm which the algae might cause. The

Board attempted to ascertain this, by getting the opinions of physicians as to the effect of Mystic Pond water contaminated by algae. The results were inconclusive, for the peculiar reason, as it developed, that relatively few people drank the water unfiltered, because of its bad taste and appearance. Unfortunately, the question stands today just where Dr. Farlow left it in 1879 — no one knows just what effect algae have on the human system.

The subject of lead poisoning as a consequence of the action of water on lead pipe was again brought up in 1885.

Beginning of the Collection of Data concerning Water Supplies

In 1879 the Legislature passed an act requiring water boards to furnish certain data relating to the supplies under their charge to the State Board of Health. The facts thus collected were published in the reports of 1882 to 1883 (Supplement), 1885 to 1886, and 1888. The "questionnaire" used to obtain these facts comprised twenty-nine questions, relating to the source of supply, quantity of water used, cost of the works, and so on.

During 1880 and 1881 a serious question arose in regard to the pollution of the Lake Cochituate supply of Boston, at Pegan Brook in Natick. A complaint was made to the Board under the provisions of the act of 1878, and an extended hearing took place as a result of which the Board ordered the parties complained of " to cease and desist from further draining and emptying human excrement, sewage and other matter, polluting and fouling the water of Pegan Brook on and after the fifteenth day of July, 1880." A petition to the court to have this decree annulled was set aside, leaving the orders of the Board in force.

On account of many mistaken notions in regard to the contamination of ground waters, J. C. Hoadley, C.E., once a member of the Board, prepared an excellent paper on the subject, dispelling some of the mysterious and unfounded ideas in regard to the direction of water currents, also

explaining the hydraulics of wells and the dangers of pollution under certain conditions. This account was published in 1883.

Sewerage Studies

It was sewerage and the disposal of sewage, however, which especially engaged attention during this period. The supplement to the report of 1879 contains a very interesting treatise on the subject by Eliot C. Clarke, C.E., Engineer of the Boston Main Drainage system. He described such preliminary operations as soil-borings and float experiments, discussed the proper sections of sewers to be used under different conditions, and gave a long account of the ways in which some of the old sewers had failed.

In Worcester the condition of the Blackstone River was becoming serious; the water of the river was too foul to be used even for manufacturing purposes. Under legislative sanction, the Board undertook an investigation of these conditions, held hearings, and appointed Dr. Charles F. Folsom, Joseph P. Davis, C.E., and Dr. Henry P. Walcott as a committee to study the problem and make recommendations. They reported in 1881, in favor of a method of sewage purification consisting of intermittent downward filtration upon an area so large (seventy-five acres) that the land could be used for growing crops, with the sewage applied at the rate of forty thousand gallons per acre daily. Colonel George E. Waring, Jr., who later became well known for his sanitary work in Havana and for the reorganization of the street cleaning department in New York City, also studied the problem in the interest of the town of Millbury, a few miles down stream below Worcester. He was the exponent of the separate system of sewers, and therefore very naturally recommended this system for Worcester. As a method of treatment, he suggested screening, subsidence, aëration, a flow through ten miles of ditches at a low velocity, and a final application to one hundred and twenty-six acres of

A Sewage Disposal suggested for Worcester

wooded swamp land — a very strange system, modern sanitarians would say. The method recommended by the committee of the Board was a logical one, and, with the omission of the agricultural features, has since been used. It was not adopted at the time, however; in fact, nothing was done until 1890, when chemical precipitation works were installed.

The sewerage of two seaside towns next received attention, namely Nahant, in 1882, and Nantucket, in 1883. In 1887, William Wheeler, C.E., made a report on the disposal of sewage at the State Reformatory at Concord.

Need of better Sewerage for the Metropolitan District

Most important, however, was the report of the legislative commission on Metropolitan Sewerage, in 1881. Ever since the report of the Miller's River Commission, in 1872, and even before that, the idea of a metropolitan sewer for the communities lying to the west and north of Boston had been discussed. One by one, the small streams, such as Alewife Brook in Cambridge, became unbearably foul. The natural remedy was to instal sewers, but there was nowhere for them to discharge, except into such streams as the Charles and Mystic rivers and these were also polluted. In fact, Lower Mystic Pond had already become a nuisance. Boston had begun the construction of its Main Drainage Works in 1876, but these did not provide for the communities lying outside of the city. Finally, in May, 1881, the Legislature passed a resolve requesting the Governor and Council to examine and report a plan for the drainage of the Mystic Valley, and within their discretion, the Charles River Valley, and the immediate neighborhood of Boston. Governor Weston referred the matter to a committee consisting of E. S. Chesborough, C.E., of Chicago, then one of the foremost sewerage engineers, Dr. Henry P. Walcott, Health Officer of the Board, Dr. C. F. Folsom, former Secretary, A. H. Boardman, and Dr. Azel Ames, Jr. Mr. Chesborough and Dr. Folsom had

been members of the Boston commission and were already familiar with the general problem.

The committee brought in a comprehensive report covering the valleys of the Mystic and Charles rivers, and a part of the valley of the Neponset River. They discussed various projects, and finally recommended a great sewerage system discharging into the harbor at Deer Island, at a total cost of about thirteen million dollars. They also recommended that a Board of Commissioners be appointed, to plan, carry out and manage the works, and to apportion the cost.

Report of the Massachusetts Drainage Commission a noteworthy Document.

The Massachusetts Drainage Commission was appointed May 28, 1884. The members were John Q. Adams, Solomon B. Stebbins, Edmund W. Converse, Edward D. Hayden, and Leverett S. Tuckerman. Eliot C. Clarke, C.E., was chosen Engineer to the Commission, with Joseph P. Davis and Rudolph Hering, Consulting Engineers. Their report was presented to the Governor on December 28, 1885. It was published as a separate document, in 1886, and forms another in the series of great engineering reports, for which the state is justly entitled to fame. The project is described in detail with plans and profiles, estimates of cost, and discussions of various projects of sewage disposal.

Especially worthy of note in connection with the work of the State Board of Health are the concluding paragraphs, said to have been written for the commission by Dr. Walcott. Looking beyond the Metropolitan District and considering the needs of the state as a whole, the report says:

> Precisely the same principle which enjoins a watchful care over the exterior waters of the State would seem to call for at least an equal solicitude concerning the abuse of its interior waters. But mindful of the tenderness with which Massachusetts has always treated the industrial classes, we think it would be wise to embrace in the enactment one peculiarly characteristic feature borrowed from the act establishing a railroad commission, and which has proved strong enough to

enforce amply all the rights of the public in that class of highways called railroads. This distinctive trait is the use of advisory as distinguished from mandatory power. We think it would be well, then, for the Legislature to designate some one or more persons to look after the public interests in this direction. Let these guardians of inland waters be charged to acquaint themselves with the actual conditions of all waters within the State as respects their pollution or purity, and to inform themselves particularly as to the relation which that condition bears to the health and well-being of any part of the people of the Commonwealth. Let them do away, as far as possible, with all remediable pollution, and use every means in their power to prevent further vitiation. Let them make it their business to advise and assist cities or towns desiring a supply of water or a system of sewerage. They shall put themselves at the disposal of manufactories and others using rivers, streams or ponds, or in any way misusing them, to suggest the best means of minimizing the amount of dirt in their effluent, and to experiment upon methods of reducing or avoiding pollution. They shall warn the persistent violator of all reasonable regulation in the management of water of the consequences of his acts. In a word, it shall be their especial function to guard the public interest and the public health in its relation with water, whether pure or defiled, with the ultimate hope, which must never be abandoned, that sooner or later ways may be found to redeem and preserve all the waters of the State. We propose to clothe the Board with no other power than the power to examine, advise and report, except in cases of violation of the statutes. — If such a Board be able to commend itself by its conduct to the approval of the great court of public opinion, it will have no difficulty, we think, in materially reducing the disorders and abuses which are threatening to give great trouble in future if not speedily checked. If, however, we err in this expectation, and more drastic measures prove indispensable, the mandate of the State can always be invoked to re-enforce its advice.

A Plan for the Control of Water Supplies and Sewerage

Finally, the report of this commission recommended a general act for the protection of the purity of inland waters. This act in substance was passed by the Legislature of 1886, and is given below. By its provisions the supervision of the water supply and sewerage of Massachusetts municipalities, including such work as should be found necessary for the

carrying out of such provisions, was intrusted to the State Board of Health.

National Board of Health

It was just as the State Board of Health was passing through its trials and tribulations in the proposed amalgamation with the Board of Charity that the United States Congress passed an act establishing a National Board of Health. The Board was organized on April 2, 1879, consisting of eleven members, and it was natural and eminently fitting that Dr. Henry I. Bowditch should have been selected as one of them. He served until 1881, when Dr. Charles F. Folsom took his place.

The National Board of Health started with great promise. Some of the best scientists of the country were drawn together under its auspices, and their investigations, published in the reports of 1879 and 1880, contain important articles. But unfortunately, Congress failed to provide adequate financial support; the work dwindled, interest flagged, and in 1885, the Board went out of existence. Be it noted, however, that in this work the State of Massachusetts did its full share.

The Water Gas Controversy

In 1884 there occurred an event of great importance to the gas industry of the state. Up to that time the gas used for illuminating purposes had been made by distilling soft coal in retorts, and was known as coal gas. But a new process had been devised in which the hydrogen of the gas was obtained by passing water in the form of steam through red hot coke, the illuminants being obtained from oil or naphtha. The product was called water gas. Water gas differs from coal gas in several respects, but chiefly in the fact that it contains a much higher percentage of carbonic oxide, an odorless, poisonous gas, resulting from the incomplete combustion of carbon. For example, the coal gas then used was found to contain 3.19 to 6.74 per cent of carbonic oxide, while water gas contained from 24.47 to 31.52 per cent. The much more

poisonous character of the water gas, coupled with its less conspicuous odor, rendered it more dangerous.

There was a long series of hearings by a legislative committee, in which science was brought to the aid of both contending business interests. Financial and utilitarian arguments finally prevailed over those of hygiene, and the right to manufacture water gas in the state was granted. In connection with this controversy, Professor William Ripley Nichols and Professor William T. Sedgwick, of the Massachusetts Institute of Technology, made a study of the relative poisonous effects of coal gas and water gas, and presented the results in the form of a joint report submitted to the General Court.[1] The data were also published in the Supplement to the Annual Report of 1884, which is reprinted in part on a later page of this volume, to which the reader is referred. At the same time Dr. Samuel W. Abbot contributed a paper showing the relation of illuminating gas to the public health. Professor Sedgwick had used animals in his experiments with the poisonous water gas and this brought upon him the wrath of the anti-vivisectionists of the day.

Experiments with Carbonic Oxide

Professor Sedgwick had been emphatic in predicting the troubles that would ensue from the use of the more poisonous water gas, and it is interesting to learn that more than twenty-five years afterward, he and one of his students compiled statistics which indicated that his predictions had been in some measure fulfilled, namely, that the use of water gas had increased the number of deaths from accidental gas poisoning. That the use of water gas reduced the cost of illumination, with possible indirect hygienic benefits, is however a fact which must be placed on the other side of the balance.

Cholera became epidemic in Europe in 1884, and it was feared that the year 1885 would find it in America. The

A Cholera Scare

[1] Senate Document, No. 60, 1885.

Legislature therefore authorized the Board of Health, Lunacy, and Charity to spend up to fifty thousand dollars in protective measures, with the approval of the Governor and Council, in case the disease became epidemic. Fortunately, the threatened disaster did not occur. Dr. Samuel W. Abbott, in his report on the subject, 1885 (Supplement), makes mention of the important discovery of the germ of the disease, the comma bacillus, by Robert Koch, in 1883. This is interesting as being one of the first references to the modern germ theory of disease in the Massachusetts reports.

Acts for the Protection of Foods and Drugs

An important event during this period was the passage of the Food and Drug Acts of 1882, 1883, and 1884. Studies of food adulteration had been made in 1879, by Mrs. Ellen H. Richards, and in 1882, by Professor S. P. Sharples, of Harvard University. In 1883, Professor Edward S. Wood, of the Harvard Medical School, made an extended investigation of the prevalence of arsenic in articles intended for domestic use, its dangers to health, and measures for prevention. In particular, a study was made of wall paper, actual samples of which are to be found in his report.

At that time, it was supposed that certain colors could not be obtained without the use of arsenic, but the situation is very different today, when we have every hue and shade from coal tar products. Thus, the arsenic problem, so far as color is concerned, has ceased to exist — an example of how the problems of hygiene change from age to age.

The law approved, May 28, 1882, placed greater powers and duties in the hands of the State Board of Health, Lunacy, and Charity; provision was made for the appointment of analysts and inspectors; and a specific appropriation of three thousand dollars was made. The next year this was increased to five thousand dollars, and the year after, to ten thousand dollars, with the proviso that not less than six thousand dollars should be devoted to the enforcement of laws relating to

milk and milk products. Except for New York, Massachusetts was the first state to commit this matter to a State Board of Health. The inspiration for this action came from the National Board of Trade. Analysts of Food, Drugs, and Milk

The officers employed to enforce the provisions of the food and drug law were, in 1883:

Dr. EDWARD S. WOOD, Analyst of Food.
Dr. BENNETT F. DAVENPORT, Analyst of Drugs.
Dr. CHARLES HARRINGTON, Analyst of Milk.
Professor CHARLES A. GOESSMANN, Analyst of Milk.

Dr. Charles P. Worcester was also employed; Dr. Samuel W. Abbott, as Health Officer, had oversight of the work. The rules and regulations in regard to the inspection and analysis of food and drugs are given in the supplement to the annual report for 1884. The increased activity of the Board resulted in materially reducing adulterations. The work was continued steadily, until 1901, when the laws were further strengthened.

During this period, it was natural that various diseases should be considered, as for example: typhoid fever (1879), malaria (1880 and 1885), cholera morbus (1880), smallpox (1880), leprosy (1882), trichinosis (1882). Of particular interest is Dr. Z. B. Adams' account of the epidemic of malaria in Framingham in 1885. The relation between this disease and standing water was clearly shown, although at that time no one knew that malaria was transmitted by mosquitoes. Studies of Diseases

In 1882, the subject of eye-strain was discussed by Dr. B. Joy Jefferies.

CHAPTER IV

THE STATE BOARD OF HEALTH REORGANIZED (1886–1914)

IN 1886, came Dr. Henry P. Walcott, as Chairman. And with him came Hiram F. Mills, C.E., of Lowell, and a new State Board of Health, — for the old order of things had passed away. This was followed by a time of reorganization and enthusiastic work, supported by popular confidence and generous appropriations, and yielding great results which cannot be told in a single chapter. We shall therefore first take a bird's-eye view of the beginnings of this period, and then describe what has been accomplished by the different departments as they existed between 1886 and 1914, when the State Board of Health was superseded by the State Department of Health. This period might well be divided into two parts; *first*, the period of great engineering enterprises, covering the first ten years, and *second*, the period of systematic organized work, covering the remaining years.

Duties of the reorganized State Board of Health

On March 24, 1886, the Act re-establishing the State Board of Health, and separating it from the Board of Charity was signed by Governor Ames. In some ways the type of organization was a reversion to that of the original Board, but the duties were broader, more specifically defined, and of a more executive character. Now, the Board was to take cognizance of:

1. The causes and prevention of infectious diseases.

2. The suppression of nuisances, including the regulation of noxious and offensive trades.

3. The collection and diffusion of information relative to industrial hygiene, or the effects of different occupations, industries, and domestic

pursuits upon people at various ages and under various conditions of life.

4. The hygiene of schools, school buildings, and public institutions.

5. The examination and investigation of public water supplies and public ice supplies, and the prevention of their pollution.

6. The investigation of drainage and sewerage systems or plans, so far as they relate to the public health.

7. The disposal and transportation of the dead.

8. The inspection of food, drugs, and other articles affecting the public health.

9. Inquiries into the causes and means of prevention of insanity.

10. Inquiries into the amount of intemperance from the use of stimulants and narcotics, and the remedies therefor.

11. The protection of human life.

12. Investigations as to the infectious diseases of animals, so far as they affect the public health, e. g., hydrophobia, trichinosis, glanders, anthrax, etc.

Organization

On Wednesday, May 26, 1886, the newly appointed members of the Board met at the State House for organization. They were

Dr. HENRY P. WALCOTT,	of Cambridge.
Mr. ELIJAH U. JONES,	of Taunton.
Mr. THORNTON K. LOTHROP,	of Beverly.
Dr. FRANK W. DRAPER,	of Boston.
Mr. JULIUS H. APPLETON,	of Springfield.
Mr. HIRAM F. MILLS, C.E.,	of Lawrence.
Mr. JAMES WHITE,	of Boston.

Dr. Walcott was unanimously elected chairman, and remained chairman until 1914, a period of twenty-eight years. Dr. Samuel W. Abbott was elected secretary, which office he held for eighteen years, until his death.

It was evident that, in order to accomplish what needed to be done, a more thorough organization would be required than that which had previously existed. The method of conducting the work through standing committees was adopted at the very outset. These committees indicate the

extent to which the work had developed. They were as follows:

FINANCE,
PUBLICATIONS,
WATER SUPPLIES AND DRAINAGE,
PUBLIC INSTITUTIONS,
FOOD AND DRUGS,
LEGISLATION AND LEGAL PROCEEDINGS,
HEALTH OF TOWNS, AND CORRESPONDENCE WITH LOCAL BOARDS OF HEALTH,
CONTAGIOUS DISEASES.

The office of the State Board of Health was at No. 13 Beacon Street, where it remained until Sept. 1, 1894, when quarters were provided in the State House. Dr. Walcott was first chosen as chairman of the committee on Water Supply and Drainage, but the next year Mr. Mills became chairman and held this position until 1915, the title of the committee being changed to Water Supply and Sewerage. In 1887, another committee was added, that on Registration of Vital Statistics.

Purity of Inland Waters

Along with Dr. Walcott and the new State Board of Health came, in 1886, a very important Act of the Legislature, entitled, An Act to Protect the Purity of Inland Waters. Let the reader turn back to see what Dr. Walcott wrote in the report of the Massachusetts Drainage Commission and compare it with the words of this act (page 125), and he will then get an idea of what Dr. Walcott's influence has been in the state during the last thirty years.

Briefly, this act placed in the hands of the State Board of Health the general oversight and care of all inland waters, directed that examinations of the waters be made to ascertain whether they are adapted for use as sources of domestic supply or likely to imperil the public health, and that recommendations be given as to the prevention of pollution. Authority was given to employ expert assistance, and to con-

duct experiments to determine the best practicable methods of purification of sewage or disposal of manufacturing refuse. The Board was also ordered to give advice to cities and towns, corporations, and individuals, as to sources of water supply and methods of sewage and refuse disposal, without expense to persons advised. Provision was also made for the submission to the Board of all plans and schemes in relation to water supply and the disposal of drainage or refuse, for its advice. And, finally, the Board was ordered to bring to the notice of the Attorney General all instances of violation of the laws respecting the pollution of water supplies and inland waters.

An Engineering Department organized

In order to carry out the provisions of this act an engineering department was created in 1886, under the following officers.

JOSEPH P. DAVIS, Consulting Engineer.
FREDERICK P. STEARNS, Chief Engineer.
X. H. GOODNOUGH, Assistant Engineer.

Mr. Stearns remained Chief Engineer until 1895, when he resigned to become Chief Engineer of the Metropolitan Water Board. He was succeeded by X. H. Goodnough, who still holds the position. With the department organized, the next need was money. Mr. Mills, who as the engineer member of the Board had been giving especial consideration to the matter, nearly staggered his associates by stating that thirty thousand dollars would be required. He realized the magnitude of the task ahead, and convinced not only the Board but the Legislature that the money would be well spent. It was, indeed, well spent, and so was many another annual appropriation of a like amount.

Systematic Water Analyses

The next year a regular system of chemical analyses was organized under Dr. Thomas M. Drown, Professor of Chemistry at the Massachusetts Institute of Technology.[1] A

[1] Professor Nichols had died from tuberculosis in 1886.

laboratory for water analyses was equipped at the Institute, in what was then called the New Building, but later known as the Walker Building. Much of the work was done by Mrs. Ellen H. Richards, the able assistant of Professor Nichols. Thus was the continuity of the analytical work maintained. George H. Parker, now Professor of Zoölogy in Harvard University, was engaged to make studies of algae, and E. K. Dunham, to make bacteriological studies in water supplies. In November, 1888, Professor William T. Sedgwick, of the Massachusetts Institute of Technology, became Consulting Biologist to the Board. George L. West succeeded Mr. Parker, and Gary N. Calkins followed him. Thus the organization for the study of inland waters comprised a staff of engineers, chemists, and biologists unequalled in America.

No sooner had the engineering department of the Board been established, than applications for advice began to come in from cities and towns. These were all carefully studied, and letters of advice promptly given. The constant increase of this work is shown as follows: the first year, eight requests for advice were received; the next year, twenty-two; ten years afterward, sixty-five; twenty years afterwards, one hundred and thirty; and in 1915 about two hundred. A more detailed account of the studies made of the inland waters will be found in Chapter IX.

The Lawrence Experiment Station

At the time when Hiram Mills was appointed to the Board, he was connected with the Essex Company of Lawrence, the company which controls the extensive water power on the Merrimack River. The company owned a building which Mr. Mills thought would make an excellent place for experiments on the filtration of sewage. And since, with him, to think was to do, this soon became the experiment station of the Board. Now, nearly thirty years afterward, it is still in operation, and the Lawrence Experiment Station has done as much as any one thing to make the Massachusetts State

Board of Health known outside of the state; the results of its researches have probably been as valuable as the results of all other American sewage experiment stations put together. Mr. Mills used to say that of all his discoveries his greatest was Allen Hazen, the young engineer-chemist from the Thayer School of Engineering at Dartmouth and the Massachusetts Institute of Technology, who was given charge of the Lawrence Experiment Station in 1886. We shall have much to say of Hazen's work in another chapter.

Allen Hazen in charge of Experiments

The force was soon increased by the advent of George W. Fuller, another Institute graduate, fresh from the Hygienic Institute of the University of Berlin and the office of Karl Piefke, well trained as a bacteriologist, who became a valuable addition to Hazen's staff, after a few years taking the latter's place in charge of the Station. Associated with these two, was Harry W. Clark, Chemist, who succeeded Fuller, and Edwin O. Jordan, Bacteriologist, with Dr. Thomas M. Drown, and Professor William T. Sedgwick, as Consulting Chemist and Biologist, respectively — with Mr. Mills, all the time, holding a tight rein, criticising, guiding, and advising. No better example can be found of the wisdom of the principle of putting money into men instead of buildings, into brains instead of elegant equipment. For the men who were trained at Lawrence have in later years advised most of the great cities of the country as to their water supplies and sewerage systems. In serving Massachusetts these men were learning to serve the nation.

Metropolitan Sewerage System studied by the State Board of Health

On June 16, 1887, the Legislature imposed another important task on the State Board of Health, that of considering and reporting a general system of drainage and sewerage for the relief of the Mystic and Charles River valleys. Evidently the administrative ability of Dr. Walcott and the skill of the engineering department of the Board to handle great questions were appreciated at the State House.

Two previous commissions had reported on this matter, in 1881 and 1884. Now it came up for more definite and detailed consideration. Two years were allowed for the work. Frederick P. Stearns was Chief Engineer, while Howard A. Carson, Charles H. Swan, and Fred Brooks gave attention to the three main divisions of the investigation, Joseph P. Davis acting as Consulting Engineer. The final report was published in 1889 and printed as a separate document. Construction work soon followed, and it was not long before the North Metropolitan Sewerage system became a reality. The project was carried out, at the cost of approximately five and a half million dollars, by the Metropolitan Sewerage Commission, which may be regarded as a child of the State Board of Health. By this expenditure an area of one hundred and thirty square miles, containing twenty municipalities, and having a population equal to one-sixth of that of the entire state, was satisfactorily drained. The system has been in continuous operation since 1894. The outlet is at Deer Island Light, off the northerly entrance to Boston Harbor.

The two Special Reports of 1890

In 1890 two special reports were published, which more than any other documents issued in America influenced the thought of sanitarians and engineers on the subjects of water supply and sewage disposal. The first, generally spoken of as Part I, related to the Examination of Water Supplies; the second, Part II, to the Purification of Sewage and Water. They contained the results of the investigations of that remarkable group of scientists, Mills, Stearns, Drown, Hazen, Mrs. Richards, Sedgwick, Fuller, Parker, and Jordan, covering a period of three active years. No sanitarian should fail to read these remarkable books, even though they are now difficult to find except in libraries.

An Epoch in Sanitation

This was indeed an epoch in sanitation. The ideas of Pasteur, Koch, and others, as to the bacterial origin of certain

diseases had come to prevail; the water carriage of disease germs had been demonstrated; biology had come to be recognized as a necessary adjunct to sanitary engineering; chemistry had already become linked with it. In fact, Dr. Drown and Professor Sedgwick in 1888 were teaching chemistry and biology to engineering students at the Massachusetts Institute of Technology. This explains the careers of three graduates who have been engineers, chemists, and biologists, Allen Hazen (M.I.T. '88), George C. Whipple (M.I.T. '89), and George W. Fuller (M.I.T. '90). Desmond FitzGerald, then Superintendent of the Western Division of the Boston Water Works, established a Biological Laboratory and Filtration Experiment Station at Chestnut Hill Reservoir in 1889, and with him were associated George C. Whipple and William E. Foss, the latter now Chief Engineer of the Metropolitan Water Supply. Engineers and sanitarians in other parts of the country were also doing important work but the Massachusetts State Board of Health was the acknowledged pioneer and leader.

Sanitary Engineering Education

On June 5, 1892, the Board advised the city of Lawrence to construct a sand filter for the purification of its water supply, which was drawn from the polluted Merrimack River, and offered the services of its experts in designing it. The advice was taken. Mr. Mills gave personal attention to the work, and the result was the first scientifically designed water filtration plant in America, put in operation, September 20, 1893. That the design has not been copied elsewhere has been due to the results of later studies, but the old Lawrence filter, as it is now called, is still in use, and has faithfully protected the citizens of Lawrence against diseases communicable by water, from that day to this. Its effect in reducing the typhoid fever death-rate in Lawrence was immediate and has been permanent. It may be said, in passing, however, that on account of the steadily increasing contamination of

The Lawrence Filter

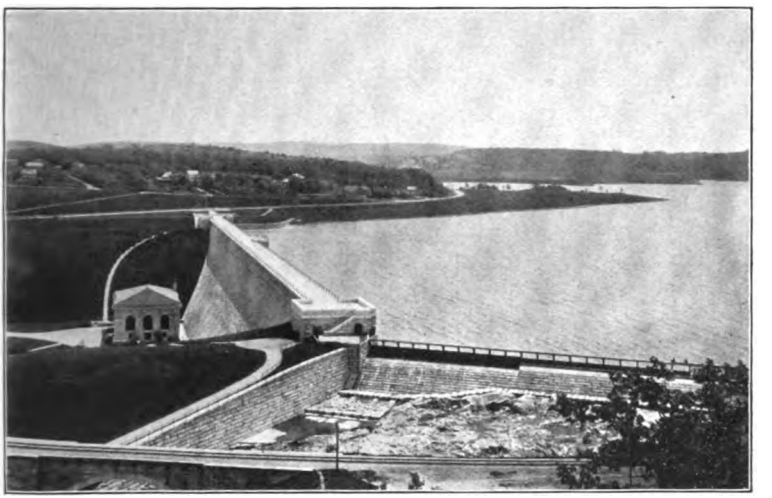
the river, due to the growth of the cities higher up along the stream, the burden placed upon the old filter is now (in 1916) greater than any filter should be called upon to bear. Supplementary filtration, or a new source of water supply for the city of Lawrence, is urgently needed. Possibly the day will come when an aqueduct from a Metropolitan Water Supply will extend along the Merrimack River Valley, supplying the various cities and towns on the river.

Thus we see that the expenditure of thirty thousand dollars a year by the State Board of Health for scientific studies very soon saved enough lives of the citizens of Massachusetts to more than pay for the cost. And this has been repeated many times since the appropriation was first granted in 1886.

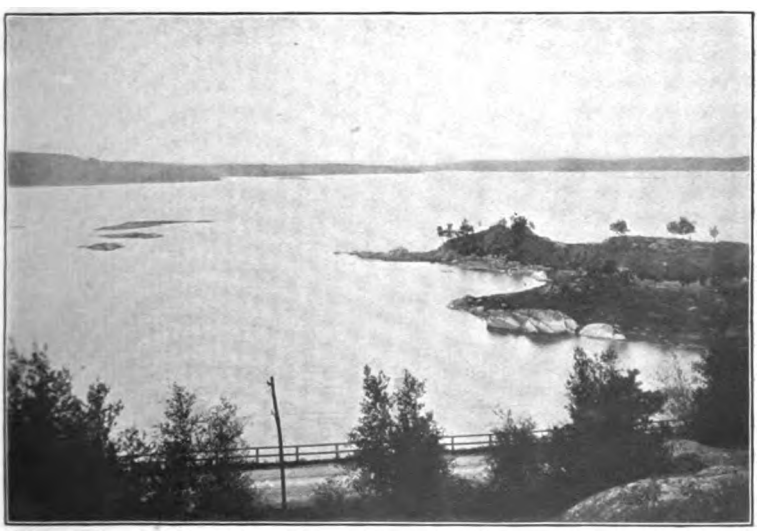
Metropolitan Water Supply for Boston

And now came the greatest triumph of all. In 1893 the Legislature passed Chapter 459, directing the State Board of Health to investigate, consider, and report plans for a new water supply for the city of Boston and its suburbs, within a radius of ten miles from the State House, and for such other cities and towns as in its opinion should be included. Forty thousand dollars were appropriated for the study.

The burden of this work fell upon the Chairman of the Board, Dr. Walcott, and the Chief Engineer, Frederick P. Stearns. For two years, they and their associates labored with this problem, and in 1895 presented a report to the Legislature, printed as a separate volume, in which the construction of a great reservoir on the south branch of the Nashua River was recommended, with aqueducts leading to the city. This stream drained the region about Mount Wachusett, and the reservoir since constructed has come to be called the Wachusett reservoir. The old supplies of Boston were retained, and suitable connections made by means of aqueducts, pipe lines, reservoirs, pumping stations, and other works. The plans were accepted by the Legislature, and the construction committed to a special commis-



Wachusett Dam and Power House



Wachusett Reservoir

METROPOLITAN WATER WORKS

sion, the Metropolitan Water Board, another offspring of the State Board of Health. Frederick P. Stearns went with the new Board, as Chief Engineer. The works were substantially completed by 1907, the total cost to date being about forty-two million dollars.

The Charles River Basin

For some years previous to 1893, the construction of a dam across the Charles River between Boston and Cambridge had been urged. Several reports had been made, including a notable one by John R. Freeman, C.E. The purpose was to create a basin of fresh water, or slightly brackish water, between the two cities, maintained at a constant level, thus doing away with the tidal flow which left the banks unsightly, foul, and ill-adapted to proper development. In spite of the manifest advantages to health and property, there was much opposition to the project. Accordingly, in 1893, the Legislature committed the matter to a Joint Board consisting of the Metropolitan Park Commissioners and the State Board of Health. Their report favored the project, and so overcame the objections that construction was soon authorized. The following year, the Joint Board reported further on the improvement of reaches of the Charles River above the portion provided for in the original legislation. As a result, Metropolitan Boston has a basin eight miles long in the very heart of its population, a great aquatic park, a financial asset, a source of civic pride, and a benefit to the comfort and health of all the people. It is destined to be surrounded with important structures, and already the new and imposing buildings of the Massachusetts Institute of Technology [1] are located upon its shore in Cambridge, while up stream are the classic buildings of Harvard, and the great Stadium, with its beautiful bridge of approach. Looking across the basin from Cambridge, at day or night, one sees the gilded dome of the State House rising over Beacon Hill — perhaps the most

[1] Dedicated in June, and occupied in September, 1916.

typical view of old Boston that can be found. The cost of this project was about four million dollars.

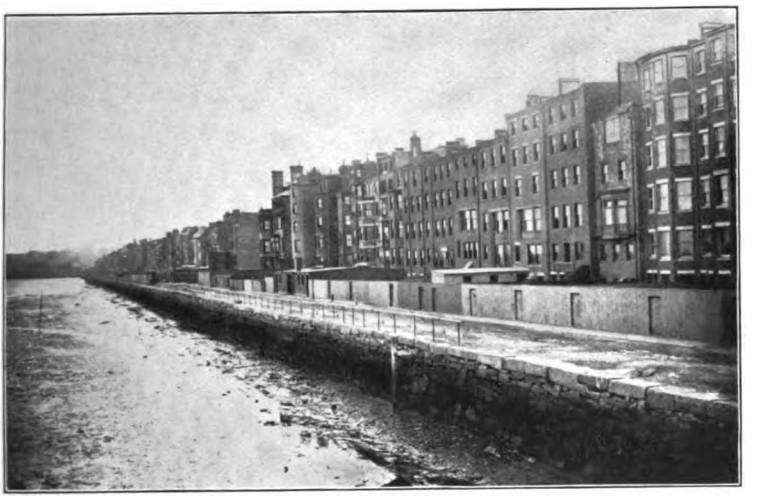
In this basin we see another triumph of the State Board of Health, attained through its spirit of co-operation — a triumph cheerfully shared with the Metropolitan Park Commission and the landscape architects of Boston, notably one now gone — Charles Eliot, son of Charles W. Eliot, President Emeritus of Harvard University, and grandson of Samuel Eliot, former Mayor of Boston.

Improvement of the Concord and Sudbury Rivers

The Concord River and its main tributary, the Sudbury, drain an extensive area of level country in the east central part of Massachusetts, and the rivers are bordered for many miles of their courses by extensive meadows which were usually wet and often inundated, even in the summer season. Previous investigations had shown that the conditions would be materially improved by removing certain bars in these rivers which obstructed the flow, and in 1894 the State Board of Health was directed to expend twenty thousand dollars in the improvement of these rivers by dredging and removing the bars which impeded the flow of the streams. The amount appropriated was subsequently increased to provide for additional work. The work was completed in 1897, and the expected improvement in the condition of the adjacent meadows has been fully realized.

Rags

It seems like a step from the sublime to the ridiculous, to turn from metropolitan water supplies, sewerage systems, and parks, to the subject of rags; yet, in the annual report for 1886, we find a long paper on this subject by Dr. Charles F. Withington, relating to the possible dangers from smallpox, cholera, and other diseases, supposed to be spread by this medium. It serves to remind us of the old theory of "fomites," the very word for which has now happily been dropped from our vocabulary, and is in striking contrast with the new ideas relating to the spread of disease.



VIEWS OF THE BOSTON SHORE OF THE CHARLES RIVER BASIN
BEFORE AND AFTER IMPROVEMENT

The Year 1895 notable for Changes

The year 1895 marked the end of the period of great engineering enterprises, although not of the engineering work of the Board, which has gone on steadily, and in increasing volume with the years. But Stearns had left to become Chief Engineer of the Metropolitan Water Board; Drown had left Boston to become President of Lehigh University; Sedgwick's connection with the Board had ceased; Hazen and Fuller had left the Lawrence Experiment Station to enter upon their famous careers as Consulting Engineers. For the next twenty years, the work with relation to water supply and sewerage was continued by those who had been understudies to the great leaders, notably, by X. H. Goodnough, C.E., who succeeded Mr. Stearns as Chief Engineer, and Harry W. Clark, who followed Dr. Drown as Chemist. The water works laboratory was soon afterwards removed from the Massachusetts Institute of Technology to the State House, and Clark was placed in charge of this work as well as that at Lawrence. They and their assistants have faithfully followed in the footsteps of their former chiefs, still guided by Dr. Walcott and Mr. Mills, whose influence continued to the end. It was in this year, also, that the Food and Drug Laboratory was established in the State House.

The year 1895 was notable for another event, — for the coming of Dr. Theobald Smith, and the establishment of the Antitoxin Laboratory. From this time on, we see the creative energies of the Board turned in new directions.

Since 1895 the work of the Board has been very thoroughly organized; in fact, this organization had been steadily developing during the preceding ten years. It will be more convenient, therefore, for us at this point to abandon the chronological method of proceding with this history, and take up the work of the various departments, even though the roots of some of them extend back into the days of the Board of Health, Lunacy, and Charity.

CHAPTER V

HEALTH OF THE PEOPLE

What is Health?

THE original State Board of Health was commanded first to take "cognizance of the interests of health and life," and second, to study the causes of disease and death. The order in which these subjects are named is not without significance. Health is the great issue, and health is something more than the absence of disease. Health demands not only freedom from disease, but a clean environment, comfortable and enjoyable conditions of living, suitable food, satisfactory provisions for work and play, and for the raising of children. The Massachusetts State Board of Health has always taken this broad view, and the people, through their representatives, have consistently upheld it. It was in this spirit that the great engineering works of water supply and sewerage, and the laying out of parks, described in the last chapter, were conceived and executed; and it was this spirit which later led to the prevention of the pollution of streams by sewage and factory waste, to the drainage of swamps, the amelioration of factory conditions, and measures prohibiting the adulteration of food. Lest it be thought that this work in the direction of promoting health has crowded out the study of the causes of disease and death, let us now go back and see what has been done. In the annual reports, this information is found under three heads: *first*, Health of Towns, *second*, Vital Statistics, including Statistics of Mortality and studies of Infectious Diseases, and *third*, Investigations of Epidemics.

Need of a new Measure of Health

It is a rather peculiar fact that the only way in which we measure the health of a people is by taking account of the amount of sickness, or the number of deaths which occur.

Having no positive measure for health, we pick out certain conspicuous lapses from health and use them as an index. This is far from being a true measure, however, for, in the first place, we usually consider only the diseases and deaths which are reported by physicians, while the latter do not report all the cases which they see and do not see all the cases that there are, minor illnesses not being recorded at all. Furthermore, while we have so-called *vital statistics* dealing with these matters, we have no *vitality statistics*. As a people, we have nothing to show as to our physique, our growth, our ability to perform the normal functions of life. We weigh the baby at birth and for a few weeks thereafter; we notice that the child is growing rapidly or slowly, but give it little concern; in later life, we occasionally put a nickel in the slot and find our weight; but the tailor or the dressmaker is the only person who keeps a record of our shape and volume. The time is coming when we shall measure health not in terms of doctor's bills, but in stature and strength, and the ability to work and to enjoy life; while the healthfulness of a place will be measured, not only in terms of death-rates, but by the capability of the environment to promote good living. The old word salubrious will then return to use with a new and amplified meaning.

Vital Statistics

From the very first, the State Board of Health endeavored to keep itself informed about the diseases prevalent in the state, by personal correspondence with local physicians — usually some chosen correspondent — and by means of the weekly bills of mortality voluntarily sent in by some of the more interested local health departments. The statistics were not very reliable, and therefore the Board secured, for publication in the annual reports, statements as to the existence of unusual amounts of sickness. For many years, these appeared quite regularly, but were discontinued after the appointment of the State Sanitary Inspectors in 1908.

Some of these statements described local sanitary conditions, and all sorts of facts supposed to be related to the public health in one way or another were included. The abatement of nuisances was evidently regarded as a most important measure. Prior to 1890, frequent mention was made of plumbing conditions, but later we find greater attention being paid to local wells. An index of the subjects treated will be found beyond, and should prove valuable to the health officers of the cities and towns concerned.

Dr. Abbott's Genius for Statistics

In studying vital statistics we need not go back of the year when Dr. Samuel W. Abbott became Health Officer. Mention has already been made of some of the early studies. Dr. Abbott had a genius for statistics. He was not content with the incomplete weekly mortality reports which were being sent to the State Board of Health at the time when he became Health Officer, nor was he satisfied to allow the Registration Reports kept in the office of the Secretary of State to remain dissociated from the public health work. He endeavored to enhance the accuracy of the voluntary weekly reports, and in the annual report for 1883 published a statistical analysis of the data collected for fourteen diseases which have a special sanitary significance, under the heading, "Weekly Mortality Reports," accompanied by diagrams. The following year, and for many years thereafter, he prepared similar reports. In 1884 he included weekly death-rates for four cities, in 1885, for a few more; and so it went on, year after year, through 1893, each report calling attention to the inaccuracy of the data.

Meantime, in 1887, Dr. Abbott was asked by the Secretary of State to take charge of editing the registration reports. This was an excellent plan, for it assured an adequate treatment of the statistics by one capable of appreciating their value, and at the same time put the State Board of Health in possession of the data so much needed for its work. Accord-

ingly, we find abstracts of the registration reports printed in the annual reports of the State Board of Health, as a part of the "General Report," from 1886 to 1893, and usually thereafter until 1905 — or as long as Dr. Abbott remained Secretary.

Reporting Cases of Disease

In 1893, a statute was enacted making it compulsory for local boards of health to report known cases of diseases dangerous to the public health to the State Board of Health within twenty-four hours. As the act failed to specify the diseases dangerous to the public health, except smallpox, the Board issued the following list of diseases which it considered to come within the meaning of the act; viz., scarlet fever, measles, typhoid fever, diphtheria, membranous croup, cholera, yellow fever, typhus fever, cerebrospinal meningitis, hydrophobia, malignant pustule, leprosy, and trichinosis.

The next year, 1894, another act was passed requiring all cities and town of more than five thousand population to send an annual report of deaths to the State Board of Health.

Thus, beginning with the annual report of 1893, we find in the reports sections entitled Statistical Summaries of Disease and Mortality, which include, first, summaries of weekly mortality reports received from town clerks, city registrars, and other officials; second, the fatality, that is, the ratio of deaths to cases in certain infective diseases, namely, diphtheria, scarlet fever, typhoid fever, and measles; third, reports of cases of diseases dangerous to the public health received from cities and towns under the provision of the act of 1893, above mentioned; and fourth, annual reports of deaths received from cities and towns under the law of 1894.

State Registration of Births, Deaths and Marriages

The state registration of births, deaths, and marriages dates from the Act of March 3, 1842. The records are kept in the office of the Secretary of State, and there is an un-

broken file of annual reports since the year mentioned. Indices to these reports, to the special articles contained in them, and to the legislative acts which have been passed from time to time, may be found on a later page.

In the early attempts to establish a State Board of Health it was intended to include among its functions the keeping of the records of vital statistics, for it was recognized that these statistics were an inseparable adjunct to public health work, but the transfer was not made at the time, nor has it been made since, although repeatedly urged by the medical societies. Almost from the beginning, however, the tables of statistics have been accompanied by "editorial observations" in which different topics of interest were discussed. From 1869 to 1890, these studies were made by the members or secretaries of the State Board of Health, notably by Dr. George Derby, Dr. F. W. Draper, Dr. C. F. Folsom, and Dr. Samuel W. Abbott. This established a co-operation between the two departments which was advantageous. From 1891 to 1909, the editorial work was done by Dr. Francis A. Harris.

Model Law not adopted

In 1914, an attempt was again made to transfer the state registrar's work to the State Board of Health, in order to make it conform to the model law which the United States Census Bureau hopes to see universally adopted for vital statistics, in the interest of uniformity. This attempt failed. The adoption of the model law would appear to be a desirable step, but it may be possible to obtain the desired results by improving some of the methods of collecting and tabulating the data, and by securing a working co-operation between the State Department of Health, the State Registrar in the Secretary of State's office and the Bureau of Statistics, which now has charge of the taking of the state census.

It is a fact well known to students of the subject that the death-rates given in the State Registration Reports often do

not agree with those published by the State Board of Health, while both are often different from those found in local reports. Obviously, this is a disgraceful condition which should not be tolerated. Disagreement of Statistics

Dr. Abbott was not content to be a mere compiler of statistics; he studied them in order to make them useful, making all sorts of comparisons and special investigations. These studies were published from time to time, and are worthy of special mention. In 1882, he discussed leprosy; in 1884, the effect of illuminating gas, and cholera; in 1889, influenza and diphtheria at Lawrence; while in 1891, he prepared an elaborate treatise on the geographical distribution of certain diseases in the state. Other very important papers were those of 1896, entitled, A Forty-years Summary of the Vital Statistics of the State, and of 1897, on Vital Statistics of Massachusetts, with a " Life Table " based upon a five-year period. In 1902, in the general report of the Board, is found a discussion, written by him, on the corrected death-rate. Obviously, it is impossible to give the results of Dr. Abbott's studies in this volume. Some of them are set forth in quotations from his writings on another page. The importance of the work to the Board and the medical profession ought not to be underestimated. The Statistical Studies of Dr. Samuel W. Abbott

Other important statistical studies were those of Hiram F. Mills, on Typhoid Fever (1890), Dr. W. F. Whitney, on Cancer (1900), and Dr. Donald Gregg, on Infant Mortality (1907). Other Statistical Studies

It will not be possible in this brief history to recount more than a few of the notable outbreaks of disease which have occurred in Massachusetts since 1870, and those which have been selected have been chosen, partly for their importance, and partly because of the interest that attaches to the investigations to which they gave occasion. Physicians especially interested in particular diseases may, by the use of

the index given beyond, find references to the principal articles in the annual reports.

The Grippe Epidemic of 1889–90

Many will remember the very severe epidemic of influenza or "la grippe" which swept over the country during the winter of 1889 to 1890. In Massachusetts alone, within the short period of six weeks, more than three-quarters of a million people were attacked, or approximately one person in every four. Bronchitis and pneumonia followed in its train, resulting in several thousand deaths. Dr. Abbott, Secretary of the Board, conducted an extensive investigation, which was published in the report for 1889.

Apparently the epidemic started in Russia in October, 1889; in November, it was prevalent in Berlin, Vienna, and Paris; in December, in London. It reached New York about December 20, and Boston soon after. It occurred in Boston before it was found in the rural districts, and, in general, may be said to have followed the lines of communication, extending outward from the larger centres.

A few years before, people would have said that it was communicated through the air, and perhaps it was to some extent, but Dr. Abbott concluded that the most important factor was "human intercourse" — another name for what we now call "contact."

Unusual significance is attached to this epidemic, from a statistical point of view, because of the fact that it abnormally increased the death-rate in some of the cities of the state, among them Lawrence. This was just before the water filtration plant was installed and the subsequent decrease in the general death-rate was commonly attributed to the improvement in the water supply. To a great extent, this was so, but it was also in part due to a return from abnormal to more normal conditions.

CHAPTER VI

THE ANTITOXIN AND VACCINE LABORATORY

BEFORE the days of bacteriology, almost the only means that could be employed to protect the health of the people against communicable diseases were improvements in general sanitation, the elimination of nuisances, and the encouragement of better habits of living. These were important, of course, and they are still important, but in the former days, the trouble was that the methods used were aimless. The foe was microscopic — unseen, unknown. When the germ theory, which had long been dawning, burst forth as a sunbeam from the researches of the illustrious Pasteur, the whole situation was illumined. Sanitarians no longer worked in darkness, their weapons could be aimed with precision at a definite enemy, and walls of defense raised where they would be effective. We have already seen how one of these defensive measures was employed with telling effect at Lawrence, a measure which, more than any other single agency, has protected whole peoples against disease — the filtration of water. In establishing the principles of the purification of water and sewage, the Massachusetts State Board of Health did pioneer work of a high order. We shall now see how it took the lead in another movement, of almost equal importance—the manufacture and free distribution of antitoxin and vaccine.

The Germ Theory established by Pasteur

The Klebs-Loeffler bacillus, the cause of diphtheria, was discovered in 1884, and this was followed in 1892, by Behring's discovery that the blood of animals treated with diphtheria toxin acquired antitoxic properties which could be utilized for the protection of human beings against the

disease. Furthermore, Behring, Roux, and others found that it could be manufactured on a large scale.

Free Distribution of Diphtheria Antitoxin

In 1894, Dr. Walcott, following the lead of New York City, conceived the idea of establishing a laboratory where antitoxin could be manufactured under state supervision, and from which it could be distributed free to all who needed it. This was a new departure, and in that year, was considered by some to be a policy of doubtful expediency. The employment of the method was, however, inevitable, for its success had been proved, while there was danger in leaving the manufacture in private hands — danger that the price would be kept so high that the poor could not afford to use it, and danger that the product itself might be improperly made, and thus likely to kill instead of cure. Twenty years experience has shown that the policy was eminently wise, and that this scientific institution, always economically managed, has been a blessing to the state, especially to those persons unable to afford the commercial cost of the remedy.

In November, 1894, Dr. J. L. Goodale began the preparation of antitoxin serum in a laboratory at the State House, the horses needed being kept in a stable on the grounds of the Bussey Institution of Harvard University, at Forest Hills. A small amount of serum was distributed in the spring of 1895. The arrangement was merely tentative, and the real work was commenced in May, when Dr. Theobald Smith was called to take charge of it. The coming of Dr. Smith marked another epoch in the history of the Board, and as already mentioned, helped to make the year 1895 a notable one. He had already become the foremost American scientist in his particular field, and that Massachusetts had the benefit of his services was due to the munificence of Dr. George F. Fabyan, who endowed a chair of comparative pathology in the Harvard Medical School, the University making Theobald Smith the first incumbent.

The Laboratory at the Bussey Institution

For nine years Dr. Smith used the laboratory rooms in the Bussey Institution for the state work, in connection with his experimental researches. Less than two thousand bottles of antitoxin were made the first year, but in four years the output increased to twelve thousand bottles. Then came the diphtheria epidemic of 1900, when the annual number of bottles of antitoxin distributed jumped to fifty thousand, a production which seriously overtaxed the Bussey laboratories.

About this time, also, the preparation of an antitoxin for tetanus, or lockjaw, was begun. The success of the free distribution of diphtheria antitoxin, together with an epidemic of smallpox in 1892, led to the belief that the vaccine lymph for this disease ought also to be manufactured and distributed by the state. Although the first person in America to use vaccination against smallpox was Dr. Waterhouse, a Massachusetts physician, yet, at the time we are considering, nearly all of the vaccine was being made by private companies outside of the state.

Manufacture of Vaccine for Smallpox

In 1903, the Legislature passed a bill authorizing the State Board of Health to produce and distribute antitoxin and vaccine lymph. The question of laboratory accommodations was still a difficult one, and Harvard University again came to the aid of the state by offering to build a brick laboratory on the grounds of the Bussey Institution and lease it to the state. Dr. Smith made a trip to Europe to study the latest developments in the manufacture and use of vaccine lymph, and on his return planned the very efficient laboratories, where, since August, 1904, and up to the present time, the various bacteriological products have been manufactured. A stable for the antitoxin horses was built in 1908, near the laboratory. Now, 1916, these quarters are again overcrowded, and Harvard University also needs the buildings for its own growing work. One of the necessities of the near

future, therefore, will be increased accommodations for this important department.

A Million Bottles of Antitoxin

It may be said that from the State Laboratories at the Bussey Institution under Dr. Theobald Smith's direction, in round numbers, a million bottles of diphtheria antitoxin and half a million tubes of vaccine virus have been distributed free through physicians to the people of the state. That no accidents, or unfortunate lapses from standard quality of the products, have occurred, during all this time, is the strongest possible testimonial to the careful and faithful work which has been done by Dr. Smith and his assistants.

In the annual report for 1905, Dr. Smith published an account of the work of his department, covering a period of ten years, together with a detailed description of his laboratory, illustrated by plans and photographs. The same article contains a description of the methods used for making vaccine virus. Each of the annual reports of his department contains a statement of the results obtained during the preceding year by the use of diphtheria antitoxin, the strength of the product, and other matters important to specialists. In 1911, the preparation of a serum for cerebrospinal meningitis was undertaken, and in 1913, the preparation and distribution of typhoid vaccine.

Scientific Investigations of Theobald Smith

But great as was the value of this work to the state, the value to the world of Dr. Smith's scientific work during this period was even greater. Suggestions of this are to be found in the annual reports of his departments, but his most valuable papers are published in the annals of scientific societies. The most important article which he contributed to the State Board of Health Reports is reprinted in the second volume. It was a study of toxin production, and has had a great influence on the manufacture of antitoxin, the world over, from that day to this.

Malaria

In 1897 to 1898, he made an extensive study of malaria in Massachusetts, in which he developed the theory that the disease was transmitted by mosquitoes, and that human beings, especially foreign workmen, were the carriers. This was before Ross had published his discoveries as to the life cycle of the malarial parasite in mosquitoes, and several years before certain papers bearing upon the subject of human carriers of malaria were published in Europe. But with Dr. Smith's usual caution, and not wishing to indict foreign workmen until more evidence was secured, his researches were not published until 1903, when they were summarized in the " Shattuck Lecture."

Human and Bovine Tuberculosis

Dr. Smith's work on human and bovine tuberculosis was continued throughout his nineteen years of service with the Board, and he also found time to study the anthrax, glanders, poliomyelitis, and other diseases. It seems a pity to be obliged to pass over all this valuable work in a single paragraph, but his studies have so thoroughly penetrated modern scientific literature that it is not necessary to do more than mention them here in order to show that Massachusetts is not unmindful of his achievements. Naturally, also, various practical questions were referred to him for study, among them the bacteriological changes that occur in oysters and poultry during cold storage.

Diagnostic Laboratory

In 1895, besides provisions for the manufacture of antitoxin, there was established in the State House a laboratory for the bacteriological diagnosis of diphtheria and tuberculosis, and for the examination of blood for the malarial parasite. In 1900 blood-tests of persons suspected of having typhoid fever were added to the work of this laboratory. These were known as the Widal, or agglutination tests. In order to show the extent to which this work has developed, it may be said that, in 1913, five thousand three hundred and thirty-two cultures were examined for diphtheria, two thou-

sand five hundred and twenty-five specimens of sputa for tuberculosis, one thousand five hundred and two samples of blood for typhoid, and fifty for malaria. The examinations are free to all physicians in the state, but it ought to be said here that they are tests which should now be made by local authorities, thus leaving the state laboratory more free to carry on necessary research work to improve the technique. All this diagnostic work was carried on under the general direction of Dr. Theobald Smith.

Rabies

In 1909, the Board undertook a study of rabies. Since 1904 this disease had been unusually prevalent, and it was thought that it might be wise for the state to undertake the manufacture and free distribution of the material used for inoculation, according to what is known as the Pasteur treatment. It was found that to do this would be unduly expensive, and that it would be cheaper and better, on the whole, to purchase the substance from the Public Health and Marine Hospital Service (now the United States Public Health Service), and have it distributed by the agents of the Board. Accordingly, this has been the method followed in Massachusetts.

The State Board of Health, since April 27, 1910, has furnished to registered physicians, free of cost, outfits for applying solution of silver nitrate to the eyes of new-born children, consisting of a dropper and a one per cent solution of silver nitrate. This is an important preventive of blindness.

Dr. Smith resigned in August, 1914, and from that time until the establishment of the new State Department of Health, Dr. Milton J. Rosenau, Professor of Preventive Medicine and Hygiene in the Harvard Medical School, who had become a member of the Board voluntarily, maintained an oversight of the work, with Dr. Brown in immediate charge.

CHAPTER VII

FURTHER MEASURES TO PROTECT THE PUBLIC HEALTH

THE years 1905 and 1907 mark another advance in the activities of the State Board of Health; this time in an entirely new direction, namely, an attempt to prevent disease and protect the public health by perfecting a better organization for state-wide co-operation, by exercising to a greater extent the power of inspection of individual premises, such as milk farms and factories, by giving greater attention to local outbreaks of disease, and by publishing a monthly bulletin in order to better diffuse among the people information relative to the health of the Commonwealth. Some of these efforts will now be briefly described.

Inspection of Dairies

Dr. Samuel W. Abbott, Secretary of the Board for eighteen years, died on October 22, 1904, and was succeeded by Dr. Charles Harrington. Having been Analyst of Milk to the Board for many years, he was keenly alive to the undesirable conditions on the farms of the state, as well as the unsatisfactory methods of obtaining and marketing milk; while the intimate relation between the quality of the milk supply of cities and infant mortality was coming to be realized by sanitarians as it had not been before. Acting under its general authority to conserve the public health, and to "make sanitary investigations and inquiries relative to the causes of disease," the Board, on March 1, 1905, began a systematic examination of dairies and cows by a skilled veterinary surgeon. According to the plan adopted, the detailed results of the inspections were sent to the Secretary, who, in case of unsatisfactory reports, sent letters to the

farmers, or milk contractors, or the board of health of the place where the milk was sold, calling attention to the objectionable features and suggesting corrective measures. During the first seven months, 2151 farms were inspected, of which less than 500 were entirely satisfactory. In the annual reports since 1905, the chief faults are enumerated. In 1906, the inspection of dairies in neighboring states was undertaken: that is, farms outside the state the milk from which was sold in Massachusetts. In 1906, 3421 dairies were inspected; in 1907, 2714; and since then, about 2000 each year. This inspection work accomplished good by calling attention to the need of better sanitation on the farm, but was evidently inadequate, and failed to solve the problem. Furthermore, increased activity on the part of local milk inspectors and of other state departments resulted in the repeated inspection of many farms, while some farms were not inspected at all. The spirit in which the work of the local officials was done was not always the kindliest, and the inspectors came to be viewed by the farmers, not as impartial judges, but as enemies hostile to their interests. As a result, a violent antagonism developed between the farmers, the milk distributers, the health authorities, and the public — a situation which has not yet (in 1916) ceased to exist; evidently it is one in which concerted action under the head of some state authority is needed.

Improvement in Farm Conditions

Yet looking back, it is obvious that important advances have been made. The average milk farm is in better condition than it was ten years ago, while the extremely filthy and revolting conditions observed in the early inspections have almost wholly disappeared. In 1905 only 20 per cent of the 2151 dairies inspected could be called clean, but in 1910, 65 per cent of 2067 dairies were clean, and in 1913, 66 per cent of dairies were clean. The annual reports indexed in the second volume give the detailed results of these inspec-

tions, and the most common defects are there listed. In 1913, of five thousand defects noted, we find the following most conspicuous:

Unclean tie-ups, in need of whitewashing	27%
Other unclean barn conditions	21%
Lack of milk rooms	13%
Barns in need of repair, or with poor light and ventilation	12%
Horses not separated from cows	9%
Improper care of milk and milk utensils	6%
Unclean herds	5%

State Inspectors of Health

In 1907, the Legislature passed an act[1] which greatly expanded the work of the Board throughout the state. For a long time it had been obvious that there was not a sufficiently intimate relation between the central organization at the State House and the local communities. Accordingly, through Dr. Walcott's initiative, the division of the state into fifteen Health Districts and the appointment of an Inspector of Health to each district were provided for. This was the first attempt in the United States to organize public health work in this way, but has since been followed by a similar organization in New York State; and, in its general form, the method seems likely to be copied in many states, though naturally with some variations on account of divergence in the political subdivisions. In Massachusetts, the number of Health Districts has been reduced to eight, and the title of the inspectors has been changed to "District Health Officers."

The original act provided for the appointment of the Inspectors of Health by the Governor, who also had the power of establishing their salaries, with the advice and consent of the council, having regard in each district to the extent of territory, the number of inhabitants, the character of the business there carried on, and the amount of time likely to be required for the proper discharge of the duties.

[1] Chapter 539.

Duties of Inspectors of Health

The qualifications for the appointees were that they be practical and discreet persons, learned in the science of medicine and hygiene; as a matter of fact, all of the appointees were physicians. The term of appointment was for five years. The duties of the Inspectors of Health were in part executive, in part advisory. Their executive duties were concerned with the sanitation of factories, workshops and other industrial establishments, the exclusion of minors from occupations deemed to be injurious to health, the sanitation of tenements where clothing is made, the inspection of mercantile establishments, the sanitation of station houses, and the sanitation of slaughter houses. The authority for much of this work already resided in the State Board of Health, so the Inspectors of Health acted as its agents; but the act transferred to these inspectors some of the factory inspection work previously done by the district police. The advisory authority exercised by the inspectors has, in the course of time, embraced many subjects. Local outbreaks of diseases dangerous to the public health have been studied, and local authorities advised as to the method of dealing with such outbreaks; nuisances, the sanitation of schoolhouses and tenement houses, the notification of diseases by physicians, the establishment of quarantine, and other public health matters have also received attention.

From 1907 to 1913, the annual reports of the State Board of Health contain the annual reports of the Inspectors of Health, and beginning in 1908, these reports are prefaced by a summary of their work prepared by Dr. William C. Hanson, the Assistant to the Secretary of the Board. An index of their reports by subjects may be found in the second volume. Some of the matters included in these reports deserve special mention, however.

In 1908, much attention was given to the health of employed minors. Of 43,270 minors examined, 521 were

found to be in ill health or physically unfit for work. Dr. Harry Linenthal, Inspector of Health for Suffolk County, made a long report [1] describing the hygienic condition of the tenement workrooms, the factories and workshops where clothing is made, cigar factories, candy factories, and the like. His report is illustrated with photographs of conditions, and contains many statistical data. The reports of the other inspectors were along the same general line, and included all sorts of industries.

Investigations of Factory Conditions

In 1909, arrangements were made by which the Inspectors of Health were notified by postcard of cases of infectious diseases, as soon as they occurred, which brought them into closer touch with these outbreaks, and enabled them to act more promptly.

The annual report for 1909 also contains a classification of the methods of collection, transportation, and disposal of garbage in the cities and towns of the state, based on data collected by the Inspectors. The nature of the rules and regulations, and the terms of the contracts entered into are described. In that year only two cities used the reduction process, Boston and New Bedford. Twenty-eight cities and thirty-three towns fed garbage to swine. In five towns it was buried; in three it was put in a dump; while one city and one town had it thrown out at sea.

Disposal of Garbage Studies

In the same report, mention is made of the law requiring medical and surgical appliances to be placed in factories. The annual reports from 1909 to 1912 contain many valuable references to studies of factory sanitation, and to the investigation of outbreaks of disease in various cities and towns. In 1912, the Legislature created a State Department of Labor and Industries, and on June 1, 1913, the work of factory inspection which had been done by the State Inspectors of Health was turned over to the new board.

[1] *Annual Report*, 1907, page 683.

In one of the annual reports we find these words:

An Appreciation of the Work of the Inspectors of Health

Of the many duties imposed by the Legislature upon the State Inspectors of Health, none were of greater importance or more far-reaching in their effects upon the conservation of the health of the inhabitants than the requirement that the State Inspectors of Health inform themselves concerning all influences that are, or may be, dangerous to the public health within their districts, and that they gather all possible information relative to the prevalence of communicable diseases, and to co-operate with the local health authorities in their eradication.

Acting in an advisory capacity, the State Inspectors of Health have been intermediaries between the State Board of Health and the local health authorities, thus making the resources of the State available to the small communities throughout the State. Frequent conferences are held by the State Inspectors of Health with the local boards of health in the various districts, and assistance is rendered by them on a great variety of problems on health matters which is apt to come up in any community.

The State Inspectors of Health, moreover, kept in touch with the incidence of communicable diseases in the respective cities and towns within their districts, and if it appeared that an unusually large number of cases of a communicable disease occur, or if any outbreak occurs in any place within a district, the State Inspector of Health made an immediate investigation to determine, if possible, the source of infection.

Besides the general duties and advisory powers to local boards of health, the State Inspectors of Health were given the enforcement of all laws relating to the health of persons employed in industrial establishments. Massachusetts was thus the first State in the Union to recognize that the sanitary inspection of factories is essentially a health matter and should be under the charge of the central health authority of the State.

The work of the State Inspectors of Health for the last five years has resulted in the accumulation of a vast amount of material on occupational hygiene and on factory sanitation. Not only have vast changes been brought about in the industrial establishments of the State, but extensive investigations have been made of a great variety of industries and processes in which workers are exposed to influences dangerous to health. Special investigations have thus been made of a number of

trades in which workers are exposed to dusts, to irritating and poisonous fumes, to extreme degree of temperature and humidity, and to general unsanitary working conditions. The industries thus studied included the textile industry; the pearl industry; felt hat industry; mattress and curled hair industry; the shoe industry; the rubber industry; the making of jewelry; metal polishing and buffing; a group of industries in which workers are exposed to lead poisoning, such as printing, stereotyping, monotyping, linotyping, electrotyping, paint manufacturing, potteries and manufacturing of tile; foundries; laundries; cigar factories; candy factories and the clothing industry.

As the direct result of the investigations and observations of the State Inspectors of Health and of the reports thereon to the State Board of Health, legislation of inestimable value in protecting the health of young persons was enacted in 1910 whereby minors are excluded from trades and processes which are designated by the State Board of Health as injurious to health.

Diseases Dangerous to the Public Health

Prior to 1907, the expression "diseases dangerous to the public health," which occurred in several sections of Chapter 75 of the Revised Laws, and of later acts, was nowhere defined. Consequently there was a looseness in the interpretation of the phrase by householders, medical practitioners, and local boards of health, which led to confusion and disputes. As a result, many cases of infectious diseases were not reported. On March 8th the Legislature[1] authorized and directed the Board to define what diseases were deemed to be "dangerous to the public health." On August 1st the following list was promulgated:

Actinomycosis.	Leprosy.	Tuberculosis.
Asiatic Cholera.	Malignant Pustule.	Typhoid Fever.
Cerebrospinal Meningitis.	Measles.	Typhus Fever.
Diphtheria.	Scarlet Fever.	Whooping Cough
Glanders.	Smallpox.	Yellow Fever.

Accompanying this, was another act (Chapter 480), which made compulsory the notification and registration of tuberculosis and other diseases dangerous to the public health.

[1] Chapter 183, of the Acts of 1907.

For the purpose of notification, the list above mentioned was increased, in 1907, by the addition of tetanus, trichinosis, and varicella.

Other diseases have been added to the list from time to time, so that, at present (1916), the list stands as follows:

Actinomycosis.
Anterior Poliomyelitis.
Anthrax.
Asiatic Cholera.
Chicken Pox.
Diphtheria.
Dog-bite (requiring anti-rabic treatment).
Dysentery: —
a. Amebic.
b. Bacillary.
Epidemic Cerebrospinal Meningitis.
German Measles.
Glanders.
Hookworm Disease.
Infectious Diseases of the Eye: —
a. Ophthalmia Neonatorum.
b. Suppurative Conjunctivitis.
c. Trachoma.
Leprosy.
Malaria.
Measles.
Mumps.
Pellagra.
Plague.
Rabies.
Scarlet Fever.
Septic Sore Throat.
Smallpox.
Tetanus.
Trichinosis.
Tuberculosis (all forms).
Typhoid Fever.
Typhus Fever.
Whooping Cough.
Yellow Fever.

This official pronouncement by the Board, as to the diseases dangerous to the public health, has been of material help to local officials in the enforcement of the laws relating to the notification and care of infectious diseases.

The Monthly Bulletin

For nearly twenty-five years the State Board of Health issued a weekly bulletin, but in 1906, this was changed to a monthly publication, and since January of that year, has been issued as a pamphlet of about twenty pages, more or less. The old weekly bulletins were hardly more than records of deaths and cases of infectious diseases in the cities and towns of the commonwealth, but the enlarged monthly bulletin, little by little, became a medium of public education in sanitary matters. Various topics were discussed, from time to time, by the Secretary, and by the health inspectors and heads of departments; accounts were given of the out-

breaks of disease, and of interesting cases of food and drug adulteration; important articles by well known sanitarians were abstracted or reprinted in full; acts of the Legislature relating to public health were printed in full; and in many such ways the Bulletin was made to promote the interests of public health. The Bulletin continues to be distributed free to residents of the state who desire to receive it, but in spite of its value it has never received the attention which it deserves, and its files do not appear to have been preserved by many libraries. This is unfortunate, because there are many very important articles of permanent scientific value scattered through the various numbers, such, for example, as the important accounts of the outbreaks of infantile paralysis in 1910, and the studies made in connection with it; scientific studies by Dr. Theobald Smith and Dr. M. J. Rosenau; studies of milk by Dr. Harrington; and the like. An index to all of the scientific articles found in the monthly bulletins will be found in the second volume.

Desirability of dignified Publicity in Public Health Matters

The Massachusetts State Board of Health has ever maintained a dignified and conservative attitude toward its publications, never having indulged in the use of cartoons, stories, or bright and catchy phrases, such as are found in many health bulletins; it has not "written down" to what may be called the popular level, but has endeavored to instruct the physicians, believing that it was their province, in turn, to instruct the families to whom they minister, while it was for newspaper and magazine writers to present the facts of science in a form suitable for their readers. This has given to the publications of the Board a high scientific standing, which is better recognized in Europe, perhaps, than in this country. In recent years, the annual reports have been curtailed by the state officials in charge of publications, for reasons of economy, which has led to the omission of important data, once eagerly looked for, but no longer to be found.

Some of the engineering reports, for instance, have been thus emasculated, the data being filed in the office of the department, but not available to the public, as they should be.

Exhibits

The State Board of Health extended its influence through the country, and through the world, by its exhibits. These have been sent to nearly all of the great expositions, — notably those of Chicago, in 1893; Atlanta, in 1895; Paris, in 1899; Buffalo, in 1900; San Francisco, in 1914. Mention should also be made of the tuberculosis exhibit which, since 1906, has been frequently placed before the public.

Manual of Health Laws

Massachusetts has no sanitary code, regularly adopted as such, the Legislature never having seen fit to confer broad legislative powers on the State Board of Health. In certain special fields where it was recognized that technical knowledge was necessary, the Board has been authorized to prepare rules which have the force of law. Among the matters thus subject to legislation by the Board, are: water supplies, ice supplies, shell-fish, cold storage of food, slaughtering, cremation, condition of jails. In many public health matters, general or specific, action has been taken by the Legislature itself, and the enforcement of these laws committed to local health departments. Thus there has grown up in the state a substantial body of sanitary legislation. For the convenience of all, the State Board of Health compiled these laws in a " Manual " which was first published in 1882, and revised and reprinted from time to time, the last edition being that of 1915.[1] This Manual of Laws is virtually a sanitary code.

Sanitary Condition of Public Institutions

The act which created the original State Board of Health required the Board " to advise the government in regard to the location and other sanitary conditions of any public institutions." Although this has never been a conspicuous feature of the work of the Board, it has at times occupied a

[1] Issued by the State Department of Health.

considerable amount of attention. Thus, in the annual report for 1888, we find many letters of advice to trustees of the Lunatic Hospitals at Westborough and Danvers, the Reformatories at Concord and Sherborn, the Normal School at Westfield, and the Industrial School at Lancaster. As these matters were chiefly of ephemeral interest, they need not be referred to in detail. By an order of the Legislature of 1907, the State Board of Health was directed to investigate the conditions under which new cemeteries should be established and old ones enlarged. The Board reported the results of its investigations to the Legislature of 1908, and a law was enacted providing for the regulation of the use of cemeteries by local boards of health or by the State Board of Health, in cases where cemeteries were to be located within the watershed of any source of public water supply.

Cemeteries

In 1892, in answer to many inquiries as to the regulation of the practice of medicine, the Board stated: "At present there are no requirements whatever regulating the practice of medicine in the State of Massachusetts."

Two years later the Legislature passed an act creating a Board of Registration in Medicine. All persons practicing medicine in the state were required to secure a certificate of registration from this board; new certificates are now issued only after a candidate has successfully passed a written and a practical examination. There are penalties for practicing without this license.

Registration of Physicians and Nurses

There is also a Board of Registration of Nurses, which conducts examinations and issues certificates of registration; but there are no laws forbidding the practice of nursing without a license. Registration merely assures the public that a nurse is competent.

The State Board of Health has never sought and never had any control over local nuisances. The local boards of health have full authority to abate such nuisances, as Judge Wells

No Control over local Nuisances

stated, and " their action is intended to be prompt and summary. They are clothed with extraordinary powers for the protection of the community from noxious influences affecting life and health." In case of refusal to act or neglect on the part of the local board of health an appeal may be made to the County Commissioners.[1] In this field the State Board of Health has only the power to advise. Certain classes of nuisances and those which involve more than one city or town come within the purvue of the state.

Licensing of Plumbers

In 1909, a law was passed authorizing the State Board of Health to appoint a board of three plumbing examiners, whose duty it shall be to hold examinations and issue licenses to apprentices, journeymen, and master plumbers. The rules of the board of plumbing examiners must be approved by the State Board of Health.

[1] Public Statutes, Ch. 80, sec. 36.

CHAPTER VIII

PROTECTION OF THE FOOD SUPPLY

FROM the very beginning, the protection of the food supply of the people was regarded as one of the important functions of the State Board of Health. Mention has already been made of the early studies, and especially the control of the business of meat slaughtering. The impetus given to the subject by the National Board of Trade, and the passage, in 1882, of the act to prevent the adulteration of food and drugs, have also been mentioned in former chapters. Between 1882 and 1901, this general law remained practically unaltered, but in 1891 an important change in the method of conducting the analytical work was made. The law of 1882 had defined food and drugs and what was held to constitute adulteration, but by the law of 1901,

Laws preventing the Adulteration of Food and Drugs

It was strengthened by the addition of a section prohibiting the use of certain preservatives, unless their presence and percentage are clearly set forth on the label in letters of a certain size, and by further legislation regulating the manner in which so-called compounds shall be labelled so that the purchaser may know their percentage composition. The amendment relative to the use of preservatives settled a much-vexed question; for, while the law prohibited the sale of foods containing ingredients injurious to the health of the consumer, authorities are by no means in agreement as to whether certain of the substances employed as preservatives exert an injurious influence on the system. The amendment waives the question, and leaves it to the consumer to decide whether he cares to assume the risk; but the vendor must acquaint him of the fact that the product is chemically preserved.

The safeguarding of the quality of drugs used in the cure of disease has also been considered to be important, and usually

food and drugs were considered together, in the general acts, and in the administrative and laboratory work of the Board. This was because the most important factor was considered to be adulteration, a practice which applied to both food and drugs. Recently, however, the food question has had added to it a new problem, that of protection against infection.

The subject of this chapter involves an infinity of detail. A bare index of the different kinds of food and drugs analyzed and considered in the annual reports would fill many pages, and descriptions of the methods used are subjects for specialists. It will serve the purpose of this short history if a brief account is given of the work as a whole, and the results accomplished, with more detailed mention of a few of the most important matters. Omitting the years before 1891, when the analytical work was carried on in the private laboratories of the analysts of food, drugs, and milk, we find the beginnings of the present laboratory organization in the work of Dr. Charles P. Worcester, who, beginning in a small laboratory in an office building at 994 Washington Street, Boston, first took general charge of all the analytical work of this character. The new laboratory in the State House was ready for occupancy in 1895. Dr. Worcester died, October 9, 1898, and was succeeded by his assistant, Dr. Albert E. Leach, who served until 1909, when he resigned on account of ill health, being in turn followed by his assistant, Dr. Hermann C. Lythgoe, the present incumbent. This system of regular promotion has resulted in a continuity of policy and methods otherwise difficult to obtain, and in a laboratory where so many kinds of analyses are made, this is especially desirable.

Organization of the Food Laboratory

The analysis of food and the prosecution of persons who adulterate it is not a new movement — emphatically it is not new in Massachusetts. Widespread popular agitation and public ferment over the subject of food adulteration is, how-

Unfortunate Exaggeration of the Pure Food Movement

ever, a matter of recent years. The federal food law was not enacted until 1907. Following the enactment of this law, the strenuous labors of Dr. Harvey J. Wiley, the head of the food laboratory of the United States Department of Agriculture, his spectacular experiments, the wide publicity given to the work of his department, precipitated a series of struggles in which much energy has been expended by health authorities, by manufacturers and vendors of food products, and especially by the "yellow" newspapers and magazines. The movement has been taken up by unscrupulous persons who have in some cases resorted even to blackmailing methods. While started with the best of intentions, no doubt, the pure food publicity campaign has overreached itself and very naturally is on the wane. Gradually it is being realized that the safest course, in the long run, is to trust regularly constituted health authorities, rather than amateur sanitarians, and to try cases in the courts, and not in the newspapers.

New Factors in the Food Problem

It is true, of course, that the progress of the arts has led to new modes of adulteration of food, to the more extensive use of preservatives, and to the holding of food supplies in storage for longer periods than formerly, by the use of artificial refrigeration. It is true also that food is produced and handled on a larger scale than formerly, and hence the effects of adulteration, the improper use of preservatives and cold storage are more widespread and concern larger numbers of people; there are fewer persons who produce their own food now than there were a generation ago. But there seems to be no reason to believe that there are more dishonest dealers now than in past years, and those who attempt to practice fraud are subject to greater restrictions. Our modern conditions of living, the concentration of people in large cities, the drift away from the farms, has made the feeding of the multitude increasingly difficult, and especially so by introducing the transportation element, and the necessity of

storage and preservation of food. In fact, the food problem is becoming divided into two parts, which are quite distinct — first, the problem of food adulteration or the problem of original food quality, and second, the problem of food preservation and distribution. There is a problem of food sophistication, which is economic and hygienic, and there is a problem of food deterioration, which is pathogenic. These two problems are often confused in the public mind. Both, however, are important.

Conservative Attitude of Massachusetts

The attitude of Massachusetts on the food question has for the most part been conservative. Her policy has been in no way spectacular, but one of constant and steady pressure. By frequent inspections, by the collection and analysis of samples, by legal prosecutions in the courts, all conducted in the slow and orderly manner of legal procedure — sometimes exasperatingly slow — many convictions of the guilty have been obtained; adulterated milk, food, and drugs have been driven from the market; while the quality of perishable foods has been kept at a higher standard than in the country as a whole. The record of the department of food and drugs of the State Board of Health is a highly creditable one, not alone for its length of service, but for its steady achievements and for its progressive attitude.

Mode of Procedure in the Case of Food Adulteration

The Secretary of the Board has had the supervision of the food and drug inspection work. Dr. Abbott, in the annual report for 1903,[1] described the general methods of procedure, substantially as follows:

The first step is the collection by experienced inspectors of purchased samples, which are confined chiefly to suspected products. The collectors are required to make records of each sample, including such items as the inspector's number; the date of purchase, or receipt of sample; the character of sample; the name of vendor, and his license, if a milk peddler;

[1] Page 459.

the address of place where sample was collected; names of manufacturers, brands, labels, etc., as they appeared on the goods or container. After being thus purchased in the open market, they are taken to the laboratory and delivered to the analyst, but not until all labels and marks which indicate their source have been removed, so that the analyst cannot be in any way prejudiced. In some cases samples are collected from the consumers.

The second step is that of analysis and determination as to whether the article is adulterated within the meaning of the law,[1] the result being reported to the Secretary by the analyst.

If an article is found to have been adulterated, a warning notice is sent. To prosecute retailers on first offence would often result in hardship or even prevent the desired object from being attained. The warning is usually passed on to the producer or wholesale dealer, and the evidence thus secured often leads to the conviction of the " man higher up " in the state, or to exposure by publication if outside the state. The warning therefore constitutes the third step. Finally comes the prosecution, the complaint being made in the local courts by the inspector as an individual, and the analyst appearing as witness.

The publication of the facts, analyses, etc., in the official monthly bulletin, is also required by law, and this often proves an important factor in preventing food and drug adulteration, without recourse to the more drastic measure of prosecution. The three methods of enforcement may be placed in this order: publication, warning, prosecution — all have had their influence. In carrying out the provisions of the statutes the Board has always tried to secure the conviction of the actual offender, of the party who knowingly sold the goods. This is usually the wholesaler, but the

[1] Section 18, Chapter 75 of Revised Laws.

retailer is not always innocent, as he often purchases the goods from the wholesaler with full knowledge of their character.

Extent of the Work done in the Food Laboratory

Few people realize the extent of the work done by the Department of Food and Drugs. Since the beginning of the work in 1882, nearly a quarter of a million samples of milk, food, and drugs have been collected and analyzed, and the work is going on at the rate of two or three dozen a day. During this time, also, nearly fifteen thousand prosecutions have been brought, and nearly four thousand convictions secured. The amount of money paid in fines runs well up toward a hundred thousand dollars.

By way of comparison, it may be stated that between January 1, 1907 and December 31, 1912, that is, in six years, the United States Department of Agriculture completed two thousand three hundred and ninety-one prosecutions under the United States Food and Drug Act of 1906; while during the same period the Massachusetts State Board of Health made one thousand six hundred and one prosecutions for violations of the Massachusetts food laws — or nearly two-thirds as many.

National and State Laws

The state laws deal with sales made within the state, the national law with sales made between one state and another — the laws being independent of each other. The federal prosecutions are therefore more far reaching, but it is evident that both federal and state laws are necessary to deal with the situation, for as Lythgoe has stated, " the New Hampshire law cannot prevent the manufacturer in that state from shipping adulterated food into Massachusetts, and the federal law cannot easily convict a person who ships to himself or his partner, although goods so shipped may be subject to confiscation and seizure; but under the Massachusetts law the person selling such food in the state can be prosecuted." There would appear to be an advantage in having the state

laws conform to the federal laws. This was tried; but local conditions render modifications necessary in almost every state.

Extent of the Adulteration of Food and Drugs

The annual reports of the Board give for each year the ratios of the numbers of samples of milk, other foods than milk, and drugs which do not conform to the statutes, and which are thus said to be adulterated, or below standard, to the numbers of samples analyzed. Thus in 1913, 25 per cent of the milk samples, 17 per cent of the food samples (not milk) and 15 per cent of the drug samples were below par. These figures should not be interpreted to mean that 25 per cent of the milk, 17 per cent of the food, and 15 per cent of the drugs sold in the state were adulterated, because most of the samples were taken in suspected cases. A low percentage may mean that the frequency of adulteration was low, or that a large number of good samples was collected. In all cases, it takes two figures to make a ratio, and the student of the reports must keep this in mind. In spite of this danger of false reasoning, it is believed that with the systematic methods of sample collection and analysis used there has been a very marked reduction in the frequency of adulteration of food and drugs in this state. This can be best appreciated by giving attention to certain selected groups of articles such as milk, foods, spices, and drugs.

Spices

Of these four groups spices have shown the greatest and steadiest decrease in adulteration. In 1883, about 65 per cent of the samples collected were adulterated; five years later the percentage was reduced to 20 per cent; for many years it hovered around 10 per cent and at the present time there are practically no adulterated spices sold in the state.

Foods

The record for foods is not quite as good as that for spices. From about 40 per cent, in 1883–84, the percentage fell to 10 per cent in 1894, and since then, has gradually risen to about 20 per cent. At the beginning of the work over 80 per

cent of the samples of milk collected were below grade, but this percentage soon fell to about 40. Since 1885 it has risen and fallen in waves and is now about 20 per cent. These waves were due, in part, to fluctuations in the standards themselves.

Drugs

Drugs have been extensively adulterated. For many years the percentages of samples below standard were high, but during the last ten years there has been some improvement. The fluctuations in the ratio of samples below standard are shown diagrammatically in Fig. 1.

The ratios above referred to are likely to be misleading in another way; they do not indicate the extent of the adulteration, the departure from the set standard. Lythgoe, in a review of the subject,[1] illustrates this with figures for tincture of iodine, a drug which has been analyzed for a longer period than any other. Between 1898 and 1904, the samples below standard contained from 63 per cent to 75 per cent of the required amount of iodine, whereas since 1908, the samples below standard contained from 77 per cent to 84 per cent of what they should contain. Study of the analyses indicate that, in general, the adulteration has been smaller in quantity, as well as less frequent, in recent years. Any relaxation of the work of this department would without doubt cause a relapse to old conditions.

The Milk Problem

There are two primary phases to the milk problem. The first relates to the adulteration of milk, to the addition of water or the extraction of cream, and to the addition of coloring matters and other substances to mask this dilution. The second relates to the handling of the milk, its age and condition when sold, its liability to infection. Both are important health problems. The sale of watered milk affects the pocketbook and, what is worse, it deprives the consumers — and these are largely children — of expected nourishment.

[1] *Monthly Bulletin*, June, 1914, page 262.

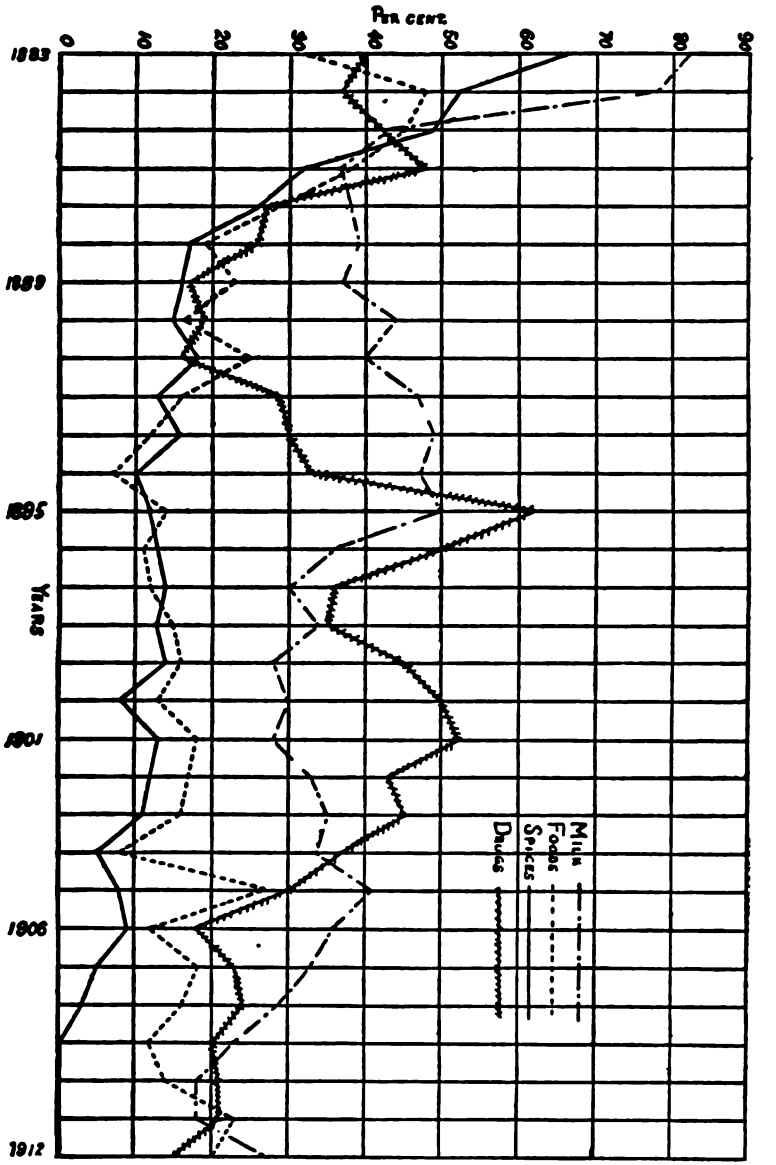


Fig. 1. Diagram showing the Decrease in the Adulteration of Foods and Drugs. (After Lythgoe)

The drinking of stale or sour or infected milk may produce digestive disturbances, or even cause disease, and hence the sale of such milk is a public health menace. Historically the chemical study of watered milk came first; the bacteriological study of milk to determine its condition being one of recent development — that is, within ten or twenty years. The activity of the State Board of Health has been directed to both phases of the problem. We have referred to the inspection of dairies elsewhere; at this point, we shall describe briefly the studies on milk adulteration.

Milk Adulteration

The statute of 1880 prescribed that milk sold in the state should contain not less than 13 per cent of solid residue and 3.7 per cent of fat; it was very soon recognized, however, that this standard was too strict for every kind of cow and every sort of condition. It was learned that the strength of the milk, measured in terms of total solids — a reasonably good test — varied with the age and breed of the cow, the time since calving, the season of the year, the nature and abundance of the feed, the care of the cows, the thoroughness of milking, and so on. Thus, while the average of the milk analyses showed between 13.2 per cent and 13.3 per cent, samples of milk known to be natural, that is, not artificially watered, often fell below the standard. Accordingly, in 1886,[1] the standard was relaxed to 12 per cent during the months of May and June. During these months the percentage of solid in good milks is often found to be between 12 and 13 per cent. In April, 1896, the relaxed standard was made to apply from April 1 to August 31. In 1899, September was added, and finally on June 13, 1908, the present standard was fixed at 12.15 per cent of milk solids and 3.35 per cent of fat, applicable uniformly throughout the year. At the time when this standard was established by the Legislature the Board advised the Senate that it would be

Changes in the Milk Standard

[1] Section 7, Chapter 209 of Acts of 1886.

reasonable and favorable to the public health to make the standard 12.25 per cent and 3.25 per cent respectively. This was the first time that the Board had advised the Legislature in regard to the milk standard. Even the statute of 1880 was not adopted upon the recommendation of the Board.

In advising the Senate, in 1908, the Board said, "While we recognize the necessity of regulating the sale of milk by a standard and the advantage of having the standard as high as is consistent with keeping cows in a healthy condition, it should be always borne in mind that of far greater importance than numerical standards in the preservation of the public health are healthy cows, kept in clean surroundings, and clean, pure milk, produced, handled, transported and delivered under sanitary conditions."

Differences in Cows

In establishing numerical standard the differences in cows had to be taken into account. The tests made in the state showed that while Jersey cows gave milk which contained on an average 14 per cent of solids and 4.92 per cent of fat, Holstein cows gave milk which contained only 12 per cent of solids and 3.31 per cent of fat. The averages for native cows were 13 per cent of solids and 3.81 per cent fats. In extreme cases the solids and fats were higher and lower than these figures. During the last twenty or thirty years the proportion of Holstein cows in the state seems to have been increasing, and cows have been bred for quantity of milk produced rather than for fats. Naturally a reduction in the standard has been demanded by the farmers. The analyses of samples made by the State Board of Health should not be taken to represent the true condition of the milk sold, because to a considerable extent the samples were chosen because watering was suspected. Lythgoe, in 1909, stated that the average milk sold in the state probably contained as much as 13 per cent of solids and 4 per cent of fats. In every annual report of the Board the details of the milk tests are fully described,

and the names of dealers found to be selling milk below standard, or colored, or containing preservatives are given. Publicity has thus been used as a powerful weapon to protect the consumers against fraud.

Bread

Space will not permit a description of the many studies which have been made to safeguard bread, butter, meat, and other foods. In 1893, samples of bread collected from bakeries patronized by the poorer classes were collected and examined with reference to their weight and quality. The average weight of a five cent loaf of white bread was four hundred and four grams; most of the bread was satisfactory in quality but some samples were sour. This was said to be due, either to the use of poor materials, or to uncleanliness in its manufacture.

Butter and Oleomargarine

It was about the year 1880, or a little before, that oleomargarine was put on the market as a substitute for butter. Its artificial coloring and misbranding caused many purchasers to be deceived. A law was, therefore, passed to prevent this substitution, and the State Board of Health was charged with its enforcement. It was recognized that oleomargarine and similar butter substitutes have a food value, but they are not butter and should not be sold as such. The original law has been amended a number of times. Almost every year some convictions of guilty dealers are obtained.

Liquors

In 1894, an effort was made to determine the quality of the liquors sold in the ordinary city saloon over the bar. The analyses of samples of whiskey, brandy, rum, gin, ale, beer, and sweet cider were given in the annual report for that year.

CHAPTER IX

PROTECTION OF THE PURITY OF INLAND WATERS

THE act to protect the purity of inland waters was passed in 1886, and was of such great importance that it is quoted in full.

ACTS OF 1886, CHAPTER 274.

Be it enacted, etc., as follows:

The famous Act relating to the Purity of inland Waters

SECTION 1. The state board of health shall have the general oversight and care of all inland waters and shall be furnished with maps, plans and documents suitable for this purpose, and records of all its doings in relation thereto shall be kept. It may employ such engineers and clerks and other assistants as it may deem necessary; *provided*, that no contracts or other acts which involve the payment of money from the treasury of the commonwealth shall be made or done without an appropriation expressly made therefor by the general court. It shall annually on or before the tenth day of January report to the general court its doings in the preceding year, and at the same time submit estimates of the sums required to meet the expenses of said board in relation to the care and oversight of inland waters for the ensuing year; and it shall also recommend legislation and suitable plans for such systems of main sewers as it may deem necessary for the preservation of the public health and for the purification and prevention of pollution of the ponds, streams and inland waters of the commonwealth.

SECTION 2. Said board shall, from time to time as it may deem expedient, cause examinations of the said waters to be made for the purpose of ascertaining whether the same are adopted for use as sources of domestic water supplies or are in a condition likely to impair the interests of the public or persons lawfully using the same, or imperil the public health. It shall recommend measures for prevention of the pollution of such waters and for removal of substances and causes of every kind which may be liable to cause pollution thereof, in order to protect and develop the rights and property of the commonwealth therein and to protect the public health. It shall have authority to

conduct experiments to determine the best practicable methods of purification of drainage or disposal of refuse arising from manufacturing and other industrial establishments. For the purposes aforesaid it may employ such expert assistance as may be necessary.

SECTION 3. It shall from time to time consult with and advise the authorities of cities and towns, or with corporations, firms or individuals either already having or intending to introduce systems of water supply or sewerage, as to the most appropriate source of supply, the best practicable method of assuring the purity thereof or of disposing of their sewage, having regard to the present and prospective needs and interests of other cities, towns, corporations, firms or individuals which may be affected thereby. It shall also from time to time consult with and advise persons or corporations engaged or intending to engage in any manufacturing or other business, drainage or refuse from which may tend to cause the pollution of any inland water, as to the best practicable method of preventing such pollution by the interception, disposal or purification of such drainage or refuse: *provided*, that no person shall be compelled to bear the expense of such consultation or advice, or of experiments made for the purpose of this act. All such authorities, corporations, firms and individuals are hereby required to give notice to said board of their intentions in the premises, and to submit for its advice outlines of their proposed plans or schemes in relation to water supply and disposal of drainage or refuse. Said board shall bring to the notice of the attorney-general all instances which may come to its knowledge of omission to comply with existing laws respecting the pollution of water supplies and inland waters and shall annually report to the legislature any specific cases not covered by the provisions of existing laws, which in its opinion call for further legislation.

Amendments

This general act of 1886 has been amended from time to time,[1] but always in line with the original spirit of the act.

The purpose of the law and its revisions was to secure the protection of the inland waters of the state, including the waters used as sources of water supply, the waters stored in lakes and reservoirs, the waters flowing in the rivers and streams, and the waters of the sea and its bays and estuaries

[1] 1888 Chap. 375, Sec. 2; 1890 Chap. 444, Sec. 1; 1897 Chap. 510, Sec. 1; 1907 Chap. 467, Sec. 1; Revised Laws of 1903, Chap. 75.

which border the shores of the state. They were designed, not only for the protection of the public health, but for the promotion also of the public comfort and well-being in its relation to water. Explanation of the Act

The act provides that cities, towns and persons shall submit to said board for its *advice* their proposed system of water supply or of the disposal of drainage or sewage, and all petitions to the general court for authority to introduce a system of water supply, drainage or sewerage shall be accompanied by a copy of the *recommendation and advice* of said board thereon. In this section the term " drainage " means rainfall, surface and subsoil water only and " sewage " means domestic and manufacturing filth and refuse.

The Board was also charged with the duty of making examinations of the main outlets of sewers and the effect of sewage disposal on the waters of the state.

In addition to the general laws, and supplementary to them, there have been upwards of one hundred and seventy special laws which defined the duties of the Board with reference to certain specific matters, concerning which the Legislature deemed essential more specific requirements than those of the general laws. Some of these special acts provided not only for *advice*, but for the *approval of plans*. This has led to an inequality of administration, which is unfortunate. Special Acts

The first report of the work done under the Act of 1886 is to be found in the annual report for the year 1887. In order to wisely advise the cities and towns of the state as to water supply and sewerage matters, it was necessary to obtain information as to existing conditions, and to keep informed about modern progress in sanitation; also to advance scientific knowledge by original experiments. This statement is no less true today than it was in 1886, and recognizing this, the State Legislature has never failed to grant the necessary funds to keep up the work.

Work done under the Act

Every annual report since 1887 has contained abstracts of the advice which has been given to cities and towns, together with abundant information regarding rainfall, stream flow, storage, water consumption, the character of water supplies, chemical and biological analyses, methods of sewage disposal, the efficiency of sewage treatment works, the effect of sewage disposal on the natural waters of the state, and other topics of a kindred nature. All of these subjects may be found indexed in the second volume of this book. Merely as illustrations of the scope of the work, a few topics will be picked out from this wonderful collection of engineering and chemical data, and referred to specifically. Many subjects treated in special articles and reports will be found abstracted in the second volume, and the most important ones are reprinted in full.

Examination of Water Supplies

The State Board of Health has vigilantly examined the quality of the public water supplies, in two ways, first, by the regular analysis of samples of water, collected by local officials and sent to the laboratory by express; second, by occasional inspections, with the collection and analysis of special samples. At first the custom was to take monthly samples from each supply, and this was continued for many years; but as the number of supplies increased, and as the quality of various supplies became better known, the frequency of sampling was diminished in places, the schedule being adjusted according to the probability of sudden variations in quality.

The detailed results of analyses are regularly sent to the water-works officials throughout the state, as soon as made, in order that they may be informed as to any unusual conditions.

Pollution of the Merrimack River

The rivers of the state have been similarly subjected to regular analysis, and the long series of samples taken for the past twenty-five years are of much interest, in showing the increasing pollution, in some cases, and the beneficial effects

of improved methods of sewage disposal, in others. It may be interesting to observe how one important river has become rapidly worse in recent years, namely the Merrimack River between Lowell and Lawrence. This may be seen from the increase in the total solids, the chlorine, and the nitrogen as free ammonia, as published in the annual report for 1913, as follows: —

Analyses of Merrimack River Water

TABLE SHOWING THE INCREASING POPULATION OF THE MERRIMACK RIVER ABOVE LAWRENCE, FROM 1887 TO 1913

(Parts per Million)

Year	Total Solids	Chlorine	Nitrogen as Free Ammonia
1887	48.2	2.2	0.027
1888	36.4	1.8	0.029
1889	——	2.0	0.047
1890	42.7	1.9	0.061
1891	40.6	2.1	0.066
1892	42.5	1.9	0.054
1893	42.5	2.3	0.084
1894	38.2	2.5	0.086
1895	44.5	3.0	0.068
1896	42.4	2.5	0.100
1897	40.6	2.1	0.061
1898	44.6	2.5	0.076
1899	44.2	3.2	0.138
1900	42.2	3.2	0.126
1901	47.3	2.8	0.100
1902	44.0	2.6	0.110
1903	46.6	3.1	0.111
1904	46.7	3.3	0.211
1905	49.2	3.8	0.177
1906	53.0	4.0	0.170
1907	49.2	4.1	0.293
1908	56.1	5.7	0.354
1909	62.8	5.3	0.336
1910	——	5.3	0.266
1911	82.2	5.3	0.240
1912	64.9	5.2	0.241
1913	74.6	5.7	0.245
1914	68.5	5.9	0.280

It should be remembered that this stream was exempted from the control of the State Board of Health by section 123 of Chapter 75 of the Revised Statutes, and also that its water,

after filtration, is used for the public water supply of the city of Lawrence. The stream pollution at Lawrence is such that the water filter is compelled to bear a load greater than such a mechanism should be called upon to bear.

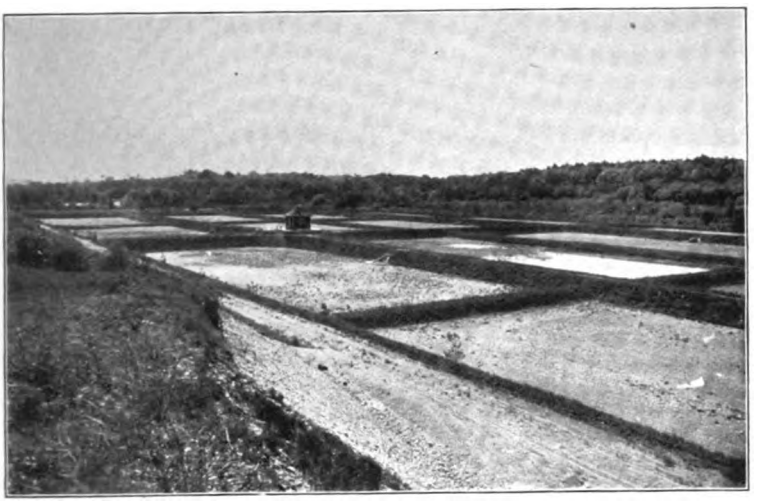
Sewer Outlets and Effect of Sewage Disposal

In 1901, the Board was specifically directed to examine all main outlets of sewers, and the drainage of the cities and towns of the Commonwealth, also the effect of sewage disposal, and to annually report the results to the General Court. Accordingly, beginning with this year, one finds in the annual reports specific mention of these subjects. The natural results of all this was to increase the amount of analytical work done in the State House Laboratories, as not only the inland waters, but the harbors and coast waters had to be studied. These investigations have been of value in connection with the troublesome problem of shellfish pollution. They have also unmistakably shown the advantages of deep sea water outlets, such as those at Swampscott and New Bedford, where the sewage is discharged at depths of thirty to sixty feet and can hardly be detected at the surface of the water. The difference between the deep Nut Island outlets of the South Metropolitan Sewerage system and the surface discharge of the North Metropolitan system of Deer Island is strikingly in favor of the deep outlet. For this reason the Deer Island outlet is now being extended to deep water.

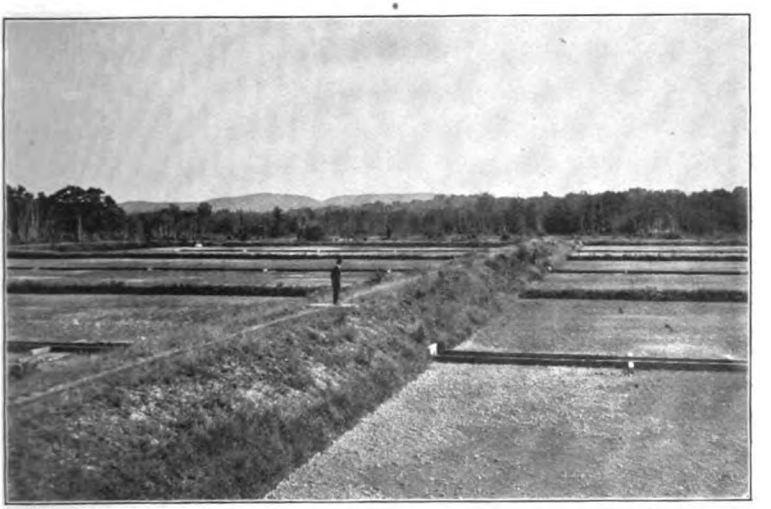
Sewage Treatment in Massachusetts

More than thirty cities and towns in Massachusetts are now provided with works for purifying their sewage or subjecting it to some form of treatment before discharging it into the waters of the state. This result can be traced directly to the advice of the State Board of Health.

On account of favorable local conditions, many of these works use the method of intermittent sand filtration, the value of which was so thoroughly demonstrated at Lawrence, and the practical benefits of which have been so evident throughout the state. As a result of increasing population,



Hudson, Mass.



Norwood, Mass.

INTERMITTENT SAND FILTERS FOR SEWAGE DISPOSAL

this system has, in some places, been outgrown; other and more concentrated methods are being gradually installed, such as trickling filters, and settling tanks of various kinds. In designing these, also, the engineers enjoy the advantage of the preliminary experimental work at Lawrence. The efficiency and reliability of some of these methods is less than that of intermittent sand filters, and therefore the State Board of Health has encouraged the use of the latter method whenever it was possible to use it economically.

Investigation of impounding Reservoirs

Many of the water supplies of Massachusetts are derived from impounding reservoirs in which the spring flood waters are stored in order to provide a supply during the summer months. These impounding reservoirs vary in size all the way from small reservoirs, holding only a few million gallons, up to the great Wachusett reservoir, which has a capacity of sixty-three billion gallons. As the storage of water plays so important a rôle, it has been extensively studied by the engineers, chemists, and biologists of the State Board of Health. The benefit of storage in protecting the public health was demonstrated by experience long before the reason for it was recognized; it is within a comparatively short time that bacteriologists learned that under normal conditions such organisms as the typhoid bacillus and the cholera bacillus die a natural death if the time interval is long enough. Storage tends to reduce the color of water, partly by equalization, that is, by admixture of the darker colored water in the streams during the spring and fall with the light-colored waters which accompany the melting snows in the spring, and partly by the bleaching action of the sun's rays in the reservoir itself. On the other hand, storage is not infrequently accompanied by growths of algae and other microscopic organisms, which impart to the water objectionable tastes and odors. These matters were studied at a very early date by Dr. Farlow and Professor Nichols, and after the organiza-

tion of the engineering department in 1887, the work was taken up anew and pursued vigorously by Stearns, Drown, Sedgwick, Calkins, and others; active researches in this field have been continued to the present time, and vast numbers of records accumulated. From the facts obtained, there has gradually developed in Massachusetts a policy which favors storing water in reservoirs from which the top soil has been removed, on the theory that this provides a substantial hygienic protection to the water consumers, improves the color of the water, and mitigates — although it does not completely remove — the occasional tastes and odors due to the development of microscopic organisms. Nowhere in the country, perhaps, has storage in clean reservoirs been so consistently advocated as by the Massachusetts State Board of Health. Many engineers question the soundness of this policy, believing that the cost is not warranted by the results and that artificial purification of the water is better and in the end cheaper. It must be admitted that the benefits of storage are well reflected in the constantly lowering death-rates from typhoid fever in the cities which obtain their supply from such reservoirs. This however is not due to soil stripping.

Soil Stripping from Reservoir Bottoms

During the early period of the work mentioned, various theories were offered to account for the development of organisms in certain reservoirs, and special emphasis was placed upon the importance of the food-supply, especially the nitrogenous matter contained in sewage and the washings from manured land. As these studies have progressed, however, it has become clear that this alone does not offer an adequate explanation of the occurrence of algae, and it is evident that the subject needs new investigations, which shall utilize some of the more modern ideas of the botanist and zoölogist; the State Board of Health, indeed, has contributed much to the problem of algae growth in reservoirs, but it cannot, as yet, be said to have solved the problem.

Water Filtration Plants

Strange as it may seem, in spite of all that the State Board of Health has done in sanitation, there are, at the present time, few water filtration plants in the Commonwealth. This condition is conspicuous to foreign sanitarians who visit the state. One of them said: "It is curious that in Massachusetts you purify your sewage, but you drink your water raw." The reason for this state of affairs has been already explained, namely, that storage has been regarded as a means of purification. There is ground for believing, however, that this condition will not always obtain, and that before many years water filtration plants will be introduced in Massachusetts, as they have been introduced elsewhere, as an additional means of safeguarding the hygienic quality of the water, and as a method of improving its color, taste, and odor and removing its turbidity. The most important surface-water filtration plant in the state, now in operation, is that at Springfield, where the supply, even though taken from a relatively uninhabited region, is filtered by the process of sand filtration, with the preliminary use of a small amount of alum, which renders the water not only safe, but clear, and without noticeable color. At Lowell and at Brookline there are sand filters to remove the iron from the water.

Mechanical Filters seldom used in Massachusetts

Except in the case of plants designed for the removal of iron from ground waters, there are no important mechanical filters in the state. Rightly or wrongly, these have never been favored by the engineers of the State Board of Health, the obvious reason being the difficulty of properly using alum with waters which are as soft as those of Massachusetts. It is perhaps well that mechanical filters designed with the short periods of coagulation common elsewhere should have been disapproved for Massachusetts conditions, because experience shows that alum cannot be used to decolorize water unless the period of coagulation is longer than that generally resorted to, while an incomplete chemical reaction tends to

increase the corrosive action of soft waters. It seems probable that it may be necessary to develop some new type of filtration particularly adapted to Massachusetts conditions. This is today a problem which awaits solution.

Advice to Cities and Towns

Perhaps no state in the union has done so much to furnish competent advice in sanitation as Massachusetts, and no engineering department is better equipped by its traditions, its experience, its personnel, and its opportunity for experimental work than that of the Massachusetts State Board of Health. The chief engineer of the Board has practically been a consulting engineer for the cities and towns of the state, as well as for corporations and individuals. Nevertheless, no attempt has been made to usurp the functions of the practicing engineer, because it was realized that it is he who should always be called upon to make the designs for the works to be installed. There is nothing in the general law which compels the cities and towns of the state to follow the advice given by the Board in matters of water supply and sewerage; it would be possible for a city to disregard it, and it would be possible, of course, for the legislature to act contrary to it, but so great has been the confidence of the public in the rulings of the Board that its letters of advice have come to have almost the force of law, and it would be difficult for cities and towns to obtain the necessary funds for sanitary works constructed contrary to the opinion of the State Board of Health. But many of the special acts have required that the plan for sanitary works be approved by the State Board of Health, and these special acts are now so numerous that the Board has a considerable measure of direct control. The letters of advice published in the annual reports are in many cases models which students of sanitation should study. Some, however, are lacking in directness.

Although the general engineering powers of the State Board of Health were made advisory, yet when it came to the

pollution of public water supplies, strong powers were conferred upon the Board; for example, the Board was authorized to prohibit the pollution with fecal matter of waters used as public supplies, and to make rules and regulations for the sanitary protection of water supplies. To this extent, the State Board has made use of legislative power expressly delegated to it. By this authority, rules and regulations have been provided for most of the surface-water supplies of the state, relating not only to sewers, but to privies, cesspools, hog yards, hitching places for animals, boating, bathing, and other things likely to be unsanitary. Rules governing Watersheds

To the State Board of Health was also given control of the ice supplies in the state, and, every year, various orders are issued in regard to the quality of these supplies.

Similarly, the State Board of Health was given charge of the sanitary condition of the shellfish industry, and was authorized to request the commissioners on fisheries and game to prohibit the taking of oysters, clams, quahaugs, and scallops from waters deemed to be contaminated. This power has frequently been made use of, thus materially decreasing the danger from shellfish obtained in the state. Shellfish

Another function of the State Board of Health has been to act with the Board of Agriculture in reclaiming wet lands, it being assumed that the drainage of such lands was of hygienic benefit to the community; while at the same time drainage properly undertaken would enhance the value of the land for agricultural purposes. This is another instance of the way in which the State Board of Health has been called upon to co-operate with other state departments in the interest of the public good. Drainage of wet Lands

CHAPTER X

THE LAWRENCE EXPERIMENT STATION AND THE STATE HOUSE WATER AND SEWAGE LABORATORIES

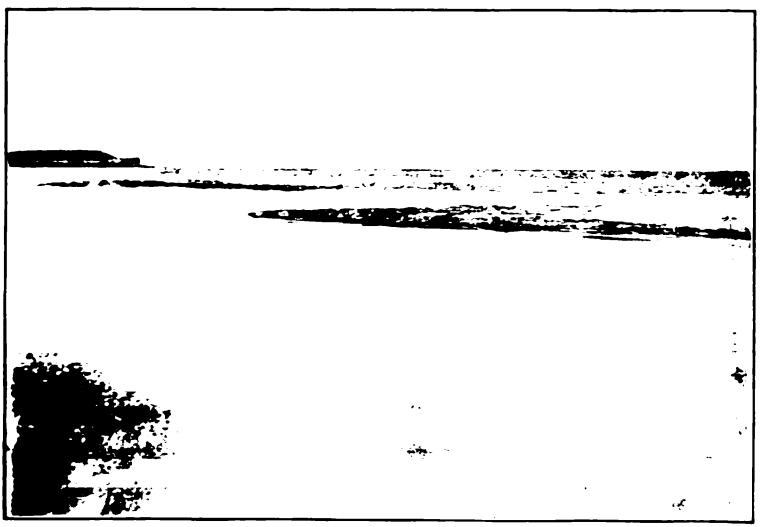
REFERENCE was made in Chapter IV to the establishment of the Experiment Station at Lawrence. During the thirty years since 1886, there has been a ceaseless flow of scientific monographs and reports from the staff of this station. Scientific researches in sewage disposal and water purification have stimulated engineers, chemists, and biologists the world around, and in some instances have profoundly influenced the practice of sanitation. For years, sanitary engineers have awaited the publication of the annual reports as important events, frequently chafing at the delay in publication due to congestion in the printing-office of the State Printer, but often attributed to the State Board of Health. Students came to regard these reports as ultimate authorities, and certain it is that, taken as a whole, no series of sanitary reports has a higher value.

Scientific Researches

The reports of the station are so numerous that no attempt will be made in this chapter to recite the experiments or their results. Mention should be made, however, of the annual report for 1908, which contained a review of twenty-one years' experiments upon the purification of sewage, by H. W. Clark and S. DeM. Gage, a document of nearly two hundred pages; and the annual report for 1909, which contained a review of the work done in connection with the disposal of factory wastes. The early work was summarized in the two special reports of 1890, already referred to as classic reports.

The Lawrence Experiment Station itself is far from impressive. A group of low, wooden buildings, and a few circu-

Lawrence Experiment Station



Discharge of Sewage in Boston Harbor

lar tanks near the river bank in an out-of-the-way part of the city are all that one sees at first glance. Inside, there are all sorts of tanks, some of wood, some of tile, some of galvanized iron, some of glass. Water or sewage is being applied to them in various ways and in different quantities. Gauges, measuring and sampling devices are to be seen everywhere, and periodically through the day and night the attendants make the necessary measurements and collect the samples for analysis. At present the station has an appearance of antiquity, for some of the older tanks have been in continuous operation for many years; but every year has seen changes, as one after another method of treatment has been subjected to careful test. But while the place looks old, there is always something new. It is not at the tanks that one should look for the work that is being done, but rather in the laboratory and its records. These are not spectacular, except in so far as voluminous books of analyses and engineering data point to an enormous amount of scientific work which has been accomplished.

Modest Equipment of the Station

The early experiments were conducted on a large scale for that day, but of late years the scale of the experimental work has been small in comparison with the elaborate stations which have been maintained for short periods in other cities. This is counterbalanced, however, by the fact that the work is done by trained and experienced men, their experience enabling them to interpret the results of small experiments, and translate them into terms of larger units. Large scale experiments are sometimes absolutely essential, but are expensive. The primary object of the experimental work has been to help the engineering department in solving the sanitary problems of Massachusetts, and this has been done adequately and at low cost.

In one of the early reports the object of the work at Lawrence was stated to be " to determine the fundamental prin-

Determination of fundamental Principles

ciples of filtration not previously established, and to learn what can practically be accomplished by filters made of some of the widely varying material found in suitable localities for filtration areas, that there may be deduced from these results, together with the quality and physical characteristics of the materials used, the probable efficiency of other materials to be found throughout the state." The report also said that "while deductions are fully made in the light of this beginning of the science of filtration, all of the data of chemical and biological analysis, and, as far as may be, the attendant circumstances, are recorded, that they may serve the future student as the means of verification or of correction in the greater light which further investigation may give him. In the presentation of these results, and their discussion, many additions to the knowledge of the world upon this important subject of purification of sewage by filtration are given."

The first work dealt with phases of sanitary science never until that time taken up in such a thorough, scientific, and comprehensive way. It was necessary to develop new and accurate methods of chemical, physical, and biological analysis, not only for water and sewage, but for sand and soils. In order to obtain some idea of the magnitude of the work done at Lawrence, it may be said that since the station was started in 1887 there have been more than four hundred filters under observation; a few of these have been run continuously from that date up to the present time. More than fifty thousand chemical analyses and one hundred and fifty thousand bacteriological analyses have been made.

Chronological Résumé of the Work

Harry W. Clark, the Chemist of the Board, has given an account of the scientific work, of which the following is a fairly close abstract, but with occasional omissions.

Beginning in 1887 with studies upon intermittent sand filtration of sewage and water, together with laboratory investigations upon nitrifi-

cation and the causes of the reduction of bacteria by filtration, the work of the station has grown constantly and has included experimental investigations tending towards the development of scientific methods of sewage purification, of the purification of manufacturing wastes of many kinds and many other special investigations in sanitary science. Sewage Purification

After the first comprehensive reports in 1890, the station took up the subjects of the permanency of filters, the mechanical composition of materials used in filters, in order that conclusions might be drawn from a study of the materials and the results of filtration, showing the capacity of each material to purify sewage and the best method of applying sewage to different grades of sand.

In 1892 and 1893, special studies were made of the care of sewage filters. These studies included stratification and the effect of horizontal layers, filtration of sewage containing dyestuffs, the rate of filtration through various materials, the causes of clogging of sewage filters, and the removal of this clogging matter from the sand. In these years, also, studies of rapid filtration aided by artificial aeration of the filters were begun.

In 1894, special investigations were made upon the composition of sewage and the changes which occur in sewage as it ages. It was shown, for instance, that storage of fresh Lawrence sewage for twenty-four hours doubled the free ammonia and decreased the organic nitrogen present one-half. Other changes, such as an increase in the number of bacteria present, also took place. This work antedated the operation of septic tanks, which have since become so well known. At this time also a series of sewage samples was collected at different periods of the day from various sewage-disposal areas and institutions in the state, and were examined to show the varying strengths of the sewage at different hours and the amount of organic matter of different kinds in the sewage per person contributing to the flow. Study of septic Tanks

In 1895, investigations were continued as to the best methods of treating sewage filters to insure permanency, the best preliminary treatment of sewage to remove sludge before filtration and the different methods of aerating sewage filters. In this year, also, were made the first experiments upon the purification by filtration of industrial sewage as discharged from tanneries, paper mills, and wool-scouring works. The stable character of the effluents from trickling filters operated at high rates, and aerated a portion of the time by means of a current of air, was first shown at this period. It was found that " the organic Study of trickling Filters

matter in the liquids, after rapid filtration combined with aeration, is of a different character from the organic matter in the sewage resulting from other sludge-removing processes; that is to say, even when the organic matter, as shown by the albuminoid ammonia, is present in quantities as great as in the other partially purified sewages, it has passed through such chemical and biological changes that it develops offensive odors very slowly on standing." These observations were made prior to the English studies upon the stability of the effluents of such filters. In this year, furthermore, certain filters of coarse materials, gravel-stones, and pieces of coke were operated at rates of 1,000,000 gallons per acre daily, and were aerated generally only from one to two and one-half hours daily. The effluents of these filters contained high nitrates, were generally stable, and, in fact, were practically similar to those afterwards obtained from filters of like materials operated at high rates without even the slight aeration given to these filters.

Study of Contact Filters

In 1896 and 1897, much time was devoted to the study of the purification of industrial sewage, and practicable methods for the purification of some of these wastes are definitely described in the reports for these years. From the first, studies looking to the removal of the matters in suspension in sewage by sedimentation, chemical precipitation and coke straining were made. In 1897, more elaborate experiments were begun on the purification of sewage by so-called contact filters, although one such filter had been studied at the station in 1894. During this year (1897) a trickling filter of clinker was also operated. To this the sewage was passed by means of overhead pipes and was aerated and distributed by the dash-plate method. This trickling filter, and all others started after this date, received no artificial aeration.

In 1898, studies were continued on the disposal of sewage, both fresh and stale, when treated in septic tanks; on the purification of industrial sewages; on the purification of sewage both by sand and contact filters. Early in 1899, there was put into operation a trickling filter 10 feet in depth, constructed of broken stone and operated at a rate of 2,000,000 gallons per acre daily. In 1899, also, studies of septic tanks and of the purification of septic sewage were continued, and the first tank for the treatment of sludge alone, after preliminary sedimentation of the sewage in ordinary settling tanks, was put into operation and continued for several years. This variety of septic tank and method of sludge disposal has since become well known. The first hydrolytic tank was started at the station in 1898. "As it had become evident that the greatest work in septic tanks occurred where the bac-

teria were most numerous, — as on the sides, bottom, and top of the tank, — it was considered that a tank filled with coarse, broken stone would afford a very extensive foothold and breeding place for the classes of bacteria necessary for sludge disposal," and the tank was so arranged that the sewage passed upward through this stone. As the result of other researches it was shown that prolongation of anaerobic action might impede subsequent purification by filtration. There were made also this year special studies relating to the purification of the wastes from creameries, and the action of iron and iron oxides on the action of purification of sewage by filtration. Study of the Hydrolytic Tank

In 1900, analyses and measurements of the gas produced by septic tanks were made and investigations concerning the efficiency of septic treatment of different classes of sewage; also experiments upon the sterilization of septic sewage. During this year the method was first elaborated at the station to show the oxygen absorption powers of sewage, this method being fundamentally the mixture of certain volumes of sewage with water saturated with dissolved oxygen and determining the oxygen consumed or absorbed by the mixture during certain definite periods.

In 1901, a thorough investigation was made of the stability of the effluents and of the organic matter left in the effluents of contact and trickling filters, together with observations on the improvement of such effluents when mixed with river water. The rate and degree of clogging of materials were also studied. In this year contact filters of roofing slate and brick, with regular spaces between each pair of slates or bricks, were first put into operation. Two of these filters are described in the report for 1901, the slate filters being similar to those operated in more recent years in England by Dibdin. Study of Slate Beds

In 1902, studies of contact and trickling filters, especially those of the latter, were continued, together with special investigations concerning nitrification and the removal of organic matter from the upper layers of sand filters.

In 1903, special efforts were made to learn the cause of the poorer winter nitrification in the older intermittent sand filters, in order to improve the work of these filters. Studies of the operation of septic tanks, trickling filters, and contact filters constructed of different materials and depths, with special regard to permanency of operation, were continued, together with allied studies upon the stability of their effluents. Numerous experiments were made on the purification of dye liquors and the waste from gas works.

The year 1904 was devoted largely to the improvement of the sand filters that had been in operation for sixteen years, and to studies of methods for the disposal of nitrogenous and other organic matters by these filters. A new method for the determination of turbidity of the effluents of filters and of water was developed and first used during this year. Studies were made of the time of passage of sewage through trickling filters constructed of different materials and of different depths, and of the rapidity of oxidation and purification of these filters.

In 1905, a continuation was made of the studies of the organic matters, nitrogen, fats, carbon, in sludge and in sewage, and of the same substances stored in filters.

In the annual report for 1906 a complete résumé was given of the comparative value of sand, contact and trickling filters for the disposal of organic matter.

In 1907, the most important special work was a continued study of methods for the distribution of sewage upon trickling filters and observations on the refiltration of trickling filter effluents through sand, together with studies of coagulation and mechanical filtration.

Factory Wastes

In the report for 1908 a complete review was given of all the investigations made at the station up to that time upon the purification of domestic sewage, and the report for 1909 contained a review of all the work done by the Board upon the purification of factory wastes. During 1910 and 1911, special studies were made upon the influence of carbon upon nitrification, the disinfection of sewage and the effluents of sewage filters and upon the determination of the character and strength of sewage by the oxygen absorption powers.

In 1912, the capacity of water to dispose of sewage and sewage effluents was investigated, as well as the effects of polluted water on fish life, the amount of water required by fish, and notably a study of the aeration of sewage.

In 1913, the new type of aeration tank was studied, and also the great problem of sludge disposal.

Water Purification

During all the years mentioned experiments were made in regard to all phases of the purification of water; during the course of which about 100 filters were operated. The filters at first were composed of fine sand or loam, but as the studies progressed sands of coarser material were used, and thorough studies made in regard to the chemical and bacterial purification of polluted waters when filtered through these sands at various rates.

Studies in regard to the purification of water containing iron were carried on in 1896.

The report for 1897 contained a résumé of the work upon the purification of water carried on during previous years in which all the factors affecting the efficiency of water filters, such as fluctuations in rate, scraping of the surface, depth of sand, were summarized.

Studies of Water Filtration

Previous to 1897, numerous tests had been made on the hygienic efficiency of various water filters, by applying to them from time to time cultures of *B. prodigiosus*, but beginning in 1896, tests for *B. coli*, which had been investigated previously, were extended; and the waters applied to, and the effluents from, all the filters of the station were examined in this way. This was the beginning of the use of the *B. coli* test for the examination of filtered waters. Such tests are now universal in all laboratories where similar work is carried on.

The report for 1898 contained an article describing the methods for determining *B. coli*. In 1899, studies of double filtration of very polluted water were continued, and also elaborate studies made in regard to the removal of color, tastes, and odors from water. This report contained a review of the work upon filters operating intermittently and continuously, with data as to the comparative efficiency of such filters when filtering water such as used in the experiments described.

In 1900, extensive examinations of the spring waters in the state were carried on, and the first work upon the examination of shellfish from polluted and non-polluted sources was done. In this report also was an article in regard to the bacterial purification of water by freezing, and an article in regard to the efficiency of water filters in removing different kinds of bacteria, the significance of *B. coli* in filtered waters, and the relative removal of *B. coli* and typhoid bacilli by water filters.

In the report for 1901 an article was given describing the results of studies made in regard to the removal by filtration of microscopic organisms, tastes and odors from a surface water supply in the state, highly colored and rendered offensive in odor by extreme growths of such organisms.

The reports for all the years subsequent to this up to the present time have contained data in regard to the purification of waters of different classes, the effect of turbidity upon the operating results of water filters, the relative occurrence of *B. coli* in waters of different kinds, in ice, shellfish, etc., the significance of the various types of bacteria used, or that can be used, to show pollution; and the relative length of life of *B. coli* and the typhoid bacillus under a wide variety of conditions.

In 1903, experiments were begun which have been continued up to the present time in regard to the purification of polluted waters by mechanical filters, that is, by filtration through a filter of coarse sand operated at a high rate with the aid of sulphate of alumina or some other like chemical as a coagulant, and data have been given in the reports to show the chemical and bacterial efficiencies of such filters when operated at varying rates and with varying amounts of coagulant.

Disinfection of Water

In the year 1904, extensive studies were made in regard to the use of copper sulphate as a germicide in water purification, and of the influence of copper sulphate in water upon the subsequent purification of such water by sand filtration. Other studies in regard to the purification of water by disinfection with such chemicals as copper sulphate, bleaching powder, and the like, have been given in different reports.

From 1907 to 1914, experiments were made on the double filtration of water, the use of upward filtration, the application of the ideas of the trickling sewage filter to water purification, and various details of mechanical filtration.

To obtain an adequate idea of the immense amount of work done at Lawrence, the reader should examine the index to the annual reports, and the abstracts of the reports themselves as given in the second volume; but even they fail to emphasize the leading ideas which have made the experiment station famous.

Biological Conception of Filtration

First of all among them should be placed the development of the fundamental conception that filtration is not merely a physical process, but a biological phenomenon; that the oxidation of organic matter in filters is brought about by the action of living organisms, and that nitrification in them is due to certain specific bacteria. Thus early did the influence of Pasteur, Koch and Frankland make itself felt in sanitary science in Massachusetts. These ideas are now so familiar to us that one sometimes fails to realize that when this work was started they were revolutionary.

In the course of the experiments, various side-lines were followed, and some of these afterwards led to far-reaching results. For example, in order to show that the oxidation of

organic matter was not a physical action alone, and was not dependent upon the passage of sewage through fine material, filters of large round gravel stones were used, which showed that the nitrifying process took place in a coarse as well as a fine grained filter. This was a side-line, because the main experiments were showing that the intermittent filtration of sewage through sand was the best method adapted to Massachusetts conditions; but the idea was taken up by English sanitarians and studied with a view to practical use, because in England sand areas are not available for intermittent filtration. Thus in England the contact bed and the trickling filter, both of which employ coarse material, came into general use, and the English scientists have generously attributed the germinal idea to the experiments conducted at Lawrence.

Or, to take a later example, we find that, in the year 1911, experiments were made by Clark on the purification of sewage by direct aeration with compressed air, the basic assumption being that growths associated with the sludge were, in this way, brought in contact with the sewage. A short time afterward, Dr. Gilbert J. Fowler, of Manchester, England, visited Lawrence, was impressed with the experiments, and carried the idea home to his associates, Dr. Ardern and Mr. Locket, who developed the process along practical lines, and gave to it the name of the activated sludge process. Clark had been devising a plan for using compressed air in a tank containing a series of slate shelves used as colloiders, but to the English experts belong the credit of seeing the practical use of sludge itself as a clarifying agent.

The Activated Sludge Process

Even the idea of the two-story tank, with its lower compartment used for the digestion of sludge, was conceived at Lawrence before the introduction of the so-called Emsher or Imhoff tank, namely in 1899. Some interesting history might be written in regard to the litigation of the Imhoff

The Two-Story Tank

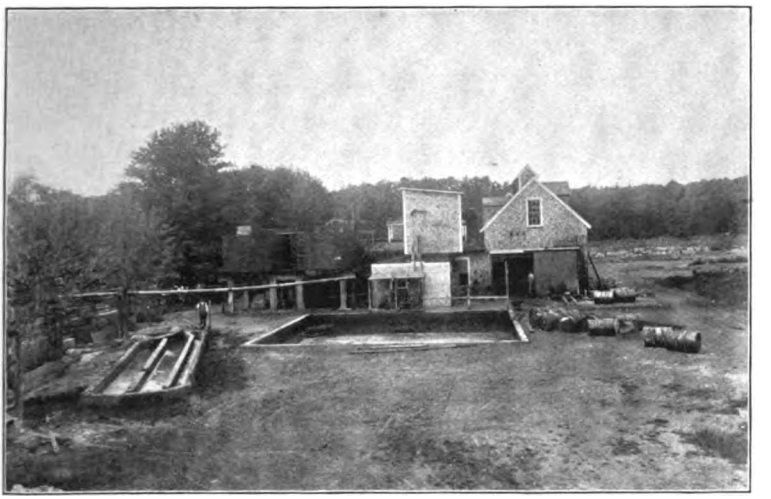
patent in Germany. Travis in England had devised what was called the hydrolytic tank, which was a two-story tank with the lower compartment almost, but not completely, protected from the flow of sewage through it. Imhoff's two-story tank was an application of Travis's idea to the old Dortmund tank which had long been used in Germany. Travis contested the Imhoff patent in Germany, but the judge failed to sustain his claims, and in his decision intimated that the ideas of both Travis and Imhoff were antedated by the experimental work at Lawrence. In fact, Imhoff himself, in a paper read at the International Congress of Hygiene and Demography, attributed the idea of separate sludge digestion to Clark. It must be admitted, however, that a number of these ideas which appear to have originated at the Lawence Experiment Station were not carried to the stage of practical usefulness by the Massachusetts engineers but by others. In this respect the State Board of Health has failed to live up to its reputation.

Experiments not followed up

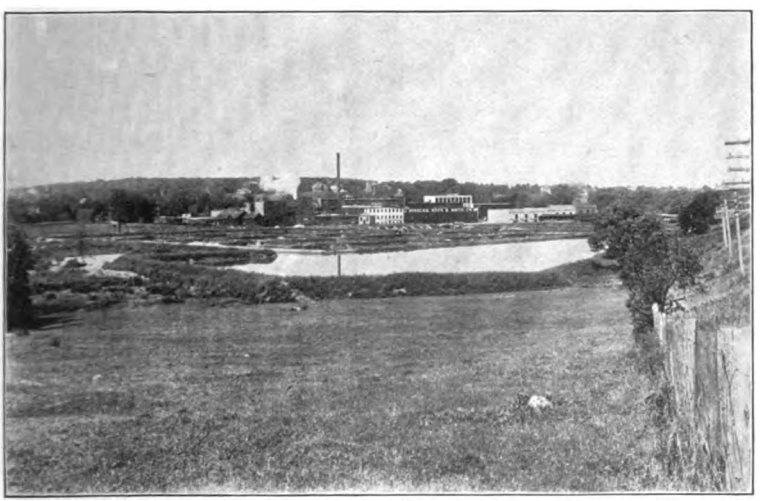
Very important, also, has been the experimental work in connection with the disposal of the local trade wastes of the state. Massachusetts is essentially a manufacturing community. Little by little, large river valleys are being built up with factories. Problems of pollution are already pressing and are likely to become aggravated as time goes on, while, on the other hand, valuable substances are being wasted, to the loss of the mill owners. In some instances it has been found that methods to prevent stream pollution could be coupled with methods of waste recovery, in such a way as not only to greatly reduce the cost, but even to make a profit to the mill owners. The underlying experiments made at Lawrence have not been spectacular, but have nevertheless been of far-reaching importance to the community.

Disposal of Trade Wastes

The laboratories for water and sewage analysis were maintained at the Institute of Technology until 1896, when they



Wool Scouring Wastes



Tannery Wastes

were removed to the State House. Since then, over a hundred thousand chemical and fifty-five thousand microscopical analyses of water have been made, this work being necessary not only on account of the legislative act of 1886, in regard to the protection of the purity of inland waters, but on account of many other special acts and resolves of the Legislature. This analytical work has been of great benefit to the cities and towns of the Commonwealth, as it maintains a ground-work of scientific facts, which not only prevents ill-advised action, but shows the necessity for various sanitary improvements.

Water Analysis Laboratories at the State House

For many years, the burden of this analytical work has fallen on Mr. F. B. Forbes, the Assistant Chemist in immediate charge of this laboratory under Mr. Clark. Only a few know of his patient, careful, and systematic work, and the author takes peculiar pleasure in here calling attention to Mr. Forbes and his work.

Although in the early days, the methods of analysis used were radical departures from ancient practices, of late years they have come to be regarded as conservative, and in some cases backward. This is naturally to be expected, because, for the sake of having long records for comparison through a series of years, not only the methods of analysis, but the modes of stating results have remained practically unchanged. This principle was followed advisedly, for it was believed to have distinct advantages to the people of the state who had become familiar with the Board's reports. Nevertheless, the analytical results are not now issued in the standard form generally used elsewhere in the country, the results of chemical analyses being stated in "parts per hundred thousand," whereas according to the Standard Method they should be expressed in "parts per million." For the same reason, many of the old chemical tests have been retained and fewer attempts made to utilize bacteriological

methods in water analysis, than is now customary in other states.

Bacteriological Work

The reason for not extending the bacteriological work is due, in part, to the expense which would be incurred in obtaining samples from distant points within the short time required in bacteriological work, but chiefly because of the recognized fact that accidents in sampling surface-waters, and errors of examination, are greater in bacteriological than in chemical work. It is undoubtedly true that a single bacteriological examination is, in general, less trustworthy than a chemical analysis. Little by little, however, the bacteriological work has been increasing in recent years. It ought to be still further increased.

Typical Water Analyses

As a typical example of the character of the analytical work done in connection with the examination of water

COCHITUATE WORKS. — CHEMICAL EXAMINATION OF WATER FROM A FAUCET AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

[Parts per 100,000.]

Number	Date of Collection	Date of Examination	Appearance: Turbidity	Appearance: Sediment	Appearance: Color	Residue on Evaporation: Total	Residue on Evaporation: Loss on Ignition	Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: Dissolved	Ammonia: Albuminoid: Suspended	Chlorine	Nitrogen as: Nitrates	Nitrogen as: Nitrites	Hardness
	1891	*1891*													
6867	Jan. 2	Jan. 2	None	V. slight	0.50	5.15	2.00	.0022	.0170	.0154	.0016	.48	.0400	.0001	2.1
6968	Feb. 3	Feb. 3	V. slight	V. slight	0.50	4.65	1.45	.0016	.0156	.0140	.0016	.37	.0380	.0001	1.9
7081	Mar. 3	Mar. 3	V. slight	V. slight	0.45	4.20	1.80	.0004	.0126	.0120	.0006	.33	.0320	.0002	1.7
7169	Apr. 4	Apr. 4	V. slight	Slight	0.33	4.45	1.65	.0006	.0138	.0116	.0022	.34	.0300	.0001	1.6
7270	May 5	May 5	Slight	V. slight	0.30	4.15	1.90	.0000	.0158	.0130	.0028	.35	.0300	.0000	1.7
7378	June 2	June 2	V. slight	Slight	0.45	4.00	1.45	.0000	.0154	.0140	.0014	.33	.0220	.0001	1.6
7521	July 2	July 2	V. slight	Slight	0.35	4.05	1.40	.0000	.0148	.0130	.0018	.33	.0180	.0002	1.4
7751	Aug. 4	Aug. 4	V. slight	Slight	0.30	4.25	1.35	.0000	.0158	.0134	.0024	.31	.0190	.0000	1.4
7883	Sept. 2	Sept. 2	Slight	Slight	0.30	4.50	1.60	.0000	.0184	.0142	.0042	.36	.0090	.0002	1.7
7996	Oct. 2	Oct. 2	Slight	Slight	0.30	4.50	2.20	.0000	.0180	.0146	.0034	.37	.0120	.0000	1.7
8195	Nov. 3	Nov. 3	V. slight	Slight	0.30	4.20	1.60	.0006	.0166	.0116	.0050	.41	.0120	.0000	1.8
8284	Dec. 2	Dec. 2	V. slight	Slight	0.40	4.55	1.15	.0004	.0190	.0166	.0024	.47	.0100	.0001	1.7
Av.	....	....	....	....	0.37	4.39	1.63	.0005	.0161	.0136	.0025	.37	.0227	.0001	1.7

Odor, none or very faintly vegetable.

Cochituate Works. — Microscopical Examination of Water from a Faucet at the Massachusetts Institute of Technology

[Number of organisms per cubic centimeter]

	1891											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Day of examination	3	4	5	6	12	3	2	5	2	2	3	3
Number of sample	6867	6968	7081	7169	7270	7378	7521	7751	7883	7996	8195	8284
PLANTS												
Diatomaceæ	241	84	128	249	1245	198	98	126	60	37	155	466
Asterionella	100	46	94	100	992	0	0	13	28	7	81	136
Cyclotella	0	0	0	44	38	3	0	30	11	4	2	31
Diatoma	0	0	1	0	6	3	0	0	0	0	0	0
Fragilaria	0	0	0	0	0	0	0	5	0	14	62	23
Melosira	124	33	28	86	86	4	5	2	0	8	0	124
Nitzschia	0	pr.	pr.	0	4	0	0	0	0	0	0	0
Stephanodiscus	8	5	3	7	22	100	92	3	0	0	1	0
Synedra	0	pr.	pr.	8	80	0	1	73	4	4	8	120
Tabellaria	9	0	2	4	17	88	0	0	17	0	1	32
Cyanophyceæ	0	0	0	0	0	0	254	509	62	54	48	66
Anabæna	0	0	0	0	0	0	2	3	1	8	20	60
Chroöcoccus	0	0	0	0	0	0	240	474	41	7	0	4
Clathrocystis	0	0	0	0	0	0	0	0	6	11	0	0
Cœlosphærium	0	0	0	0	0	0	3	0	1	8	3	0
Microcystis	0	0	0	0	0	0	9	7	13	20	5	2
Nostoc spores	0	0	0	0	0	0	0	0	0	0	11	0
Oscillaria	0	0	0	0	0	0	0	25	0	0	9	0
Algæ	1	2	pr.	2	2	11	9	147	10	24	51	21
Chlorococcus	0	2	pr.	0	2	4	4	146	0	22	25	18
Closterium	0	pr.	0	2	0	4	1	pr.	0	0	1	2
Dictyosphærium	0	0	0	0	0	0	0	0	0	0	24	0
Raphidium	1	0	0	0	0	2	0	1	10	2	1	1
Scenedesmus	0	0	0	0	0	1	4	pr.	pr.	pr.	0	0
Fungi Crenothrix	pr.	1	0	2	28	pr.	0	0	0	0	0	1
ANIMALS												
Rhizopoda. Actinophrys	pr.	pr.	0	0	0	pr.	0	0	0	0	pr.	1
Infusoria	7	0	pr.	190	6	pr.	0	5	1	2	9	26
Dinobryon	7	0	0	23	6	0	0	0	0	1	1	22
Dinobryon cases	0	0	0	0	0	0	0	4	0	0	0	2
Peridinium	0	0	pr.	2	0	0	0	0	0	0	0	2
Trachelomonas	pr.	0	0	174	pr.	pr.	0	1	1	1	pr.	pr.
Synura	0	0	0	0	0	0	0	0	0	0	3	0
Vorticella	0	0	0	0	0	0	0	0	0	0	5	0
Crustacea. Cyclops	pr.	0	0	0	0	0	0	0	0	pr.	0	0
Miscellaneous. Zoöglœa	44	24	42	16	172	33	96	30	68	92	3	38
TOTAL	293	111	170	468	1453	242	457	817	201	209	266	618

supplies, the following analyses of the Cochituate water supply are given as they appeared in the annual report of 1891.

For many years the detailed results of analyses were given in this form, but since 1900 summaries only have been published.

Extension Work

Besides the experimental work at Lawrence and at the State House, mention should be made of the research work conducted at various places in the state in order to study certain problems under their local conditions. Water filtration at Springfield and Ipswich; iron removal from water at Provincetown; sewage disposal at Andover, and the treatment of all sorts of trade wastes in many different cities are illustrations of this type of work. The operation of the water filtration plant of the city of Lawrence has been studied at the experiment station for many years. In fact, one objection to the State House laboratory has always been the difficulty of solving some of the problems at long range, the transportation of samples always introducing an element of uncertainty into analytical results, even though the work has been skilfully conducted. With modifications in analytical method is likely to come also an additional amount of field work.

CHAPTER XI

LATER ENGINEERING WORK

ALTHOUGH no works in recent years have compared in magnitude with the great undertakings described in Chapter IV, many important projects have been reported upon, and some of them have been executed by the engineering division of the Board. A brief résumé of these will be given.

Sewerage of Salem and Peabody

In the year 1895, the Board was required to consider and report plans for the collection and disposal of the sewage of the city of Salem and the town of Peabody, under the provisions of chapter 112 of the Resolves of that year. Plans for a general system of sewerage and sewage disposal were reported to the Legislature of 1897, providing for collecting the sewage, and also the great quantities of manufacturing wastes discharged from tanneries and allied industries in both Salem and Peabody, and discharging them into Salem Harbor at a point where they would not cause the pollution of neighboring shores. The works were subsequently constructed, in general accordance with the plans recommended, and were completed, and their operation begun, in the latter part of the year 1906.

Neponset River Improvements

Since 1875, the attention of the Board has been directed to the Neponset River, notably in 1886 and 1887–1891. By the provisions of chapter 83 of the Resolves of 1895, the State Board of Health was directed to investigate the sanitary condition of the river and the extensive meadows through which it flows in the towns of Walpole, Norwood, Sharon, Canton, Milton, and Hyde Park, and to report to the Legislature a plan for the improvement of the river and meadows.

The Neponset River drains an area of about a hundred and seventy square miles in the southeastern part of Massachusetts, and in the lower part of its course forms the southern boundary of the city of Boston, finding an outlet into Dorchester Bay in the southerly part of Boston Harbor. The river, at the time this resolve was passed, was being very badly polluted by sewage, and especially by foul drainage from numerous manufacturing works of various kinds, particularly paper mills, tanneries, and woolen mills. In the central portion of its course the polluted river meanders with a sluggish current for many miles through extensive fens, known as the Fowl Meadows, which cover an area of four thousand acres or more, much of which is wet or partially inundated throughout the greater part of the year.

The Board reported plans to the Legislature of 1897, both for relieving the river of pollution, and for draining the Fowl Meadows, but action upon this matter was delayed until 1902, when a law looking to the prevention of the pollution of the river was enacted. This law was subsequently (in 1906) amended so as to provide a penalty for the pollution of the stream. Since the enactment of this law much of the sewage formerly discharged into the river has been diverted, or is being purified within the watershed, and at nearly all of the manufacturing establishments, works have been constructed which provide for the treatment of the manufacturing wastes. In spite of this fact, however, some pollution still exists, as the treatment works are not in all cases adequate. In some instances the matter has been placed in the hands of the Attorney-General.

Drainage Projects

In 1911, an act was passed to provide for the deepening and improvement of the river throughout the Fowl Meadows in order that efficient drainage might be provided for that objectionable area, which had evidently long exercised a deterrent influence upon the growth of population over a very

wide region. The act directed the Board to expend a sum not exceeding a hundred and fifty thousand dollars in constructing the necessary drains, trenches, and ditches, and in dredging and deepening the channel. An engineering force was organized, and the work was begun during the latter part of the year, and by the end of 1915 had been nearly completed. Improvement is already visible in certain parts of the Meadows, and in the condition of the river through them.

Although this work was undertaken as a public health measure, the Meadows having been breeding places for mosquitoes, it is likely to prove economically advantageous to the owners of the meadow land, and therefore to the cities and towns in which it lies. It may be regarded as lying in the field of conservation as well as sanitation, and it is perhaps a forerunner of still greater projects to follow elsewhere in the state.

Improvement of Green Harbor

In 1896, the State Board of Health, sitting as a joint board with the Board of Harbor and Land Commissioners, was required to consider the question of improving Green Harbor in the town of Marshfield, where it was alleged that by the construction of a dike reclaiming fifteen hundred acres of marsh land, at the edge of the sea, and by closing a former tidal estuary known as the Green Harbor River, the harbor supplied by this river had been damaged and its usefulness largely destroyed.

The joint board reported the results of its investigations to the Legislature of 1898, recommending that the dike be retained, and the harbor improved and maintained by dredging. A second report was made in 1908.

South Metropolitan Sewerage System

Under the provisions of chapter 65 of the Resolves of the Legislature of 1899, the State Board of Health was directed to consider the general subject of the discharge of sewage into Boston Harbor, and the disposal of sewage for the metropolitan districts of the Commonwealth, and also to report a

plan for an outlet for a high level gravity or other type of sewer for the relief of the Charles River and Neponset River valleys.

The Board, after investigation, recommended the discharge of the sewage of these river valleys — later known as the South Metropolitan Sewerage District — into the sea at two points north of Paddock's Island in the southerly part of Boston Harbor. The plan was adopted by the Legislature, and the works which were constructed by the Metropolitan Sewerage Commission were completed and first operated in the year 1904. These outlets are located at the bottom of the harbor where the water is thirty feet in depth at low tide, and the quantity of sewage discharged here at the present time amounts to more than forty million gallons per day. These deep Nut Island outlets have proved so successful that the outlet of the North Metropolitan Sewer at Deer Island is being carried into deeper water.

Advantage of deep Sewer Outfalls

In the year 1903, the State Board of Health was directed to report upon the dumping of garbage and rubbish into the harbor and along the seacoast of Massachusetts Bay. The results of the investigation were reported to the Legislature in 1904, and more stringent regulations on harbor dumping have since been adopted.

Mystic River and Alewife Brook

In the year 1904, the Legislature passed an act requiring the State Board of Health to examine the Mystic River and Alewife Brook and their tributaries, and present a report of its investigations with recommendations for purifying those waters and preventing further injury to the public health by reason of the unsanitary conditions existing in the valleys of these streams. The Board found that Alewife Brook was badly polluted by sewage and manufacturing wastes, and that malaria was prevailing to an alarming extent in the region about the Alewife Brook marshes, an extensive tract of low land lying partly in the cities of Cambridge and Somer-

ville, and partly in the towns of Arlington and Belmont, and having an aggregate area of about a thousand acres. Portions of these marshes were found to be below the level of ordinary high tide, and the Board recommended the construction of a dam across the Mystic River at Craddock Bridge to maintain the water at a constant level, about seven feet above low tide; also the enlargement of the channels of the streams and construction of suitable drainage in the Alewife Brook marshes, to provide proper drainage and prevent the breeding of mosquitoes therein. The prevention of the pollution of the streams was also recommended. The Legislature subsequently provided for the construction of works, in general accordance with the plans recommended, and a dam across the Mystic River has lately been completed, the work being done under the direction of the Metropolitan Park Commission.

Water Supply of Lynn

By the provisions of chapter 509 of the Acts of the year 1906, the State Board of Health and the Water Board of the City of Lynn were authorized and directed to investigate plans for enlarging and improving the water supply of that city. The results of the investigation were reported to the Legislature of 1907. An act was passed authorizing the city to proceed with the works. Plans were made and approved by the Board, but delays occurred, and an extension of time was obtained. The city then submitted plans for the use of mechanical filters, but the Board advised against them on the ground that while this type of filtration would remove the color of the water, it would fail to do away with tastes and odors, would make the water harder or corrosive to metals, and that experience had not shown that for a soft, colored water this mode of filtration could be depended upon to produce a satisfactory water supply. The case caused much discussion as it apparently indicated a strong prejudice of the Board against the use of mechanical filtration, which involves

the use of a chemical coagulant, with the soft, colored waters of the state. Whether the decision of the Board in the Lynn case was wise is a question which is still open for debate; but as a result, the Lynn water still remains unfiltered.

Merrimack River

Mention has already been made of the increasing pollution of the Merrimack River. By the provisions of chapter 114 of the Resolves of 1908 the State Board of Health was directed to investigate its sanitary condition and report thereon to the General Court. The results of this investigation showed the need of better regulation of the condition of this river, which had hitherto been exempted from the general laws relative to the pollution of rivers in Massachusetts, and, in accordance with the recommendations of the Board, presented in its report to the Legislature of 1909, the Merrimack River was included in the laws relating to the prevention of the pollution of streams. By the provisions of another law the Board is directed to report to the Legislature upon the improvement of the river whenever its condition becomes objectionable.

Water Supply of Salem, Beverly, and Peabody

By the provisions of chapter 54 of the Resolves of the year 1911 the State Board of Health was authorized and directed to consider and report on the matter of a water supply for the cities of Salem and Beverly, and the town of Peabody, taken from the Ipswich River and its tributaries, or from any other source or sources that the Board might find available. The results of this investigation were presented to the Legislature in 1911 and 1912. A joint Water Commission for Salem and Beverly was created, and new works are now under construction.

Other special studies made by the engineering division of the Board can be mentioned only by name. The list includes an investigation of the Pollution of Boston Harbor by the Sewage Discharged at Moon Island (1908), the Pollution of the Danvers River and its Tributaries (1913), Improvement

of the Shores of Dorchester Bay (1913), and the Condition of Lake Cochituate with reference to its Purity as a Source of Water Supply (1912). Many of the most important reports are to be found among the letters of advice to cities and towns.

The repeated references to legislative acts in recent years have been inserted in order to emphasize the extent to which the engineering work of the Board in recent years has been increased by special legislation.

A study of the reports of the engineering division of the State Board of Health shows that the Board conducted work which was not always directly related to the suppression of disease or the control of epidemics. So far as the water resources of the state are concerned, it has acted as a conservancy board, looking after the pollution of streams and the protection of riparian owners against unsanitary conditions, looking after the water supplies, with respect to their use by different communities, and acting as an advisory arbiter between different interests. This work has been done with thoroughness, with economy, and with general satisfaction to the people. The credit for this is due to the engineering staff, to Hiram F. Mills, the engineer member of the Board, to Frederick P. Stearns, the first Chief Engineer, and to X. H. Goodnough, the present Chief Engineer.

It must not be thought that this conservancy work is outside of the domain of public health or the well-recognized functions of a State Board of Health — far from it. Health is more than the absence of disease; comfort, convenience, and decency all make for health. Who would deny that the great Metropolitan Water Supply System of Boston or the Charles River Basin or the Metropolitan Sewer Systems were public health measures? What the State Board did for Boston, in a large way, it is doing for all the cities and towns of the state in proportion to their size and needs.

In the same way the State Board of Health has acted as a conservancy board to protect the people against adulterated food. Watered milk, oleomargarine, and ill-prepared canned goods do not necessarily spread disease, but they do impair the nourishment of the people and impose a fraud upon purchasers. In the broad sense this, too, is a public health measure and an important one.

CHAPTER XII

COST AND ACHIEVEMENTS OF THE STATE BOARD OF HEALTH

In the last seven chapters we have considered the work of the various divisions since 1895. It now remains to review, in a more general way, the achievements of the State Board of Health; to see what the work has cost and how it has paid. This will require the consideration of a few statistics.

Population of the State

When the first census of the country was taken in 1790 the population of the state was less than 400,000. The million mark was reached in 1851, the two-million mark in 1888, the three-million mark in 1904, and the five-million mark will probably be reached about 1920. The growth in population is shown by Fig. 2. From this it will be seen that it is the urban population which has increased; villages have grown to large towns and these, in turn, to cities. The number of people living in towns of less than eight thousand inhabitants has increased but little in a hundred years. When the State Board of Health was established in 1869 the population was about 1,450,000; in 1886, when the Board was reorganized, it was 2,050,000; in 1914, when the State Department of Health replaced the Board, it was 3,600,000. In 1869, 750,000 lived in cities and towns of more than eight thousand inhabitants; in 1914, there were nearly 3,000,000. In 1869, Boston had a population of about 250,000; in 1915, it was nearly 750,000.

The composition of the population has greatly changed in forty years. In 1870, seventy-five per cent of the population were native born and fifty-seven per cent of native parentage; in 1910, sixty-eight per cent were native born and only thirty-

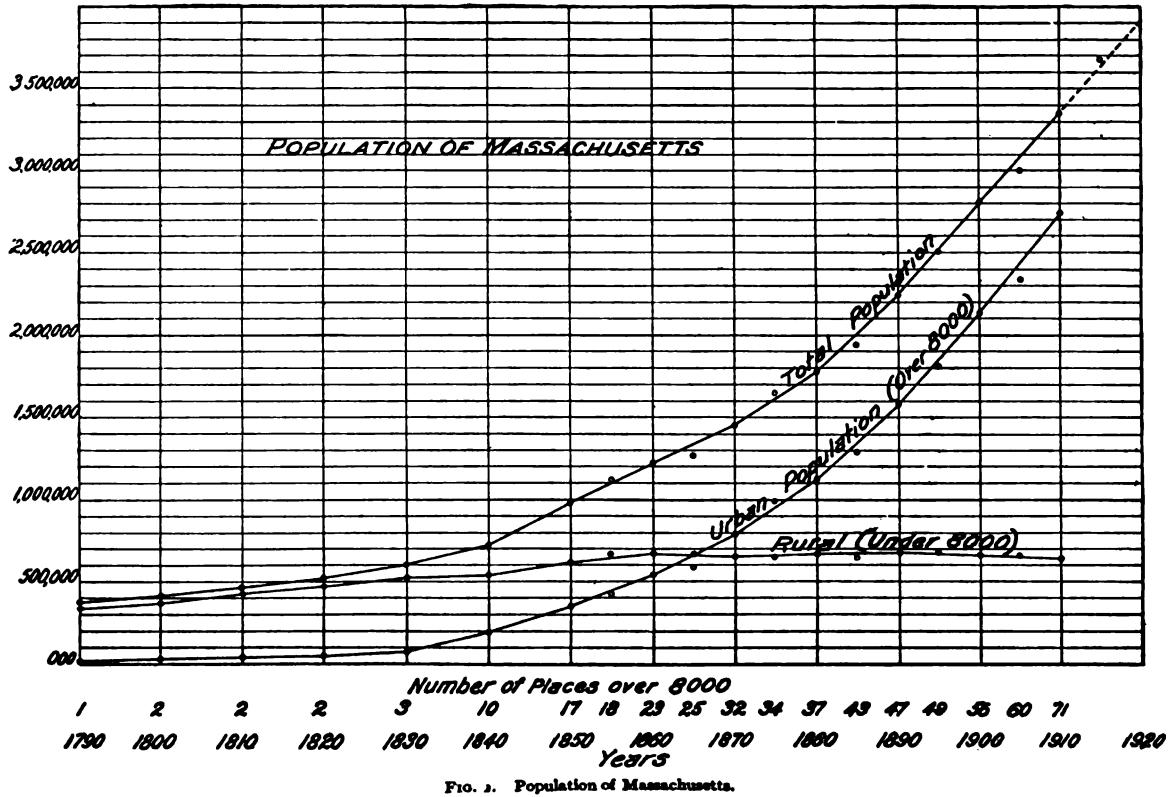


FIG. 2. Population of Massachusetts.

three per cent of native parentage. The cause of this change was, of course, the alien immigration. The rapid growth

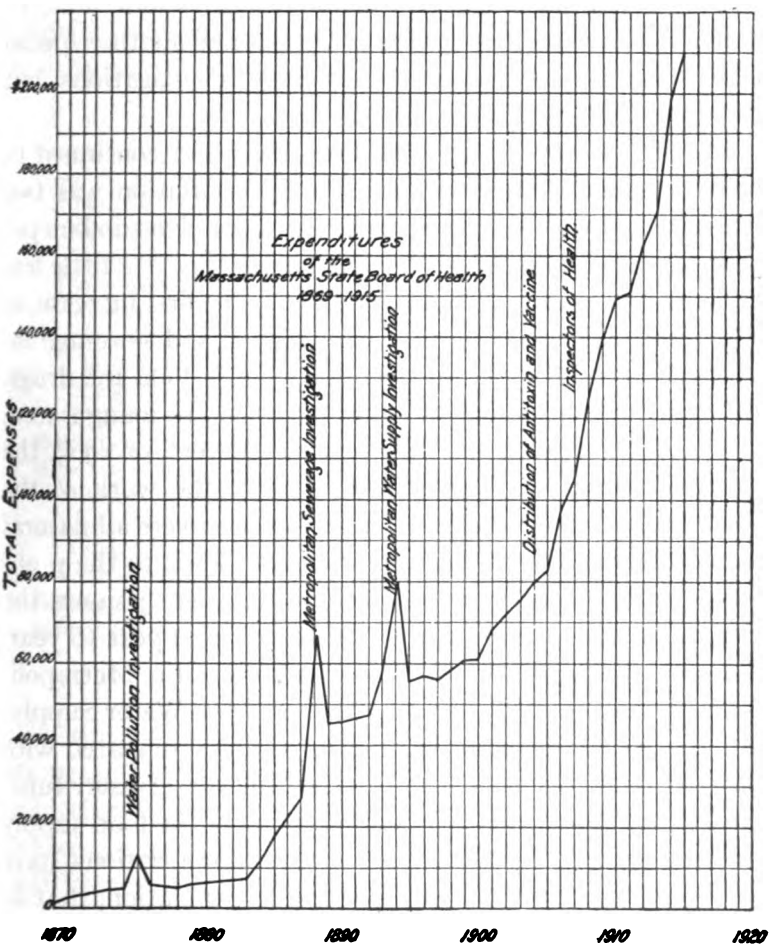


FIG. 3. Expenditures.

and concentration into cities show the need for increased activity in the control of the public health.

Appropriations

During the first calendar year of the Board, 1870, the total expenses were only two thousand, two hundred and eighty-eight dollars, and until 1887, they hardly ever exceeded five

thousand dollars per year. This was equivalent to about two dollars per year for each thousand of the state's population. In 1875, there was a special expense of eighty-four hundred dollars for the study of stream pollution, and another special expense in 1885 on account of sewerage investigations, but these were the exceptions, not the rule.

In 1887, however, the work broadened and continued to increase steadily until, in 1914, the appropriation was two hundred and nine thousand dollars, or fifty-eight dollars per year for each thousand of the population, that is a little less than six cents per year for each person. The first increase, in 1887, was occasioned by the water supply and sewerage investigation and the greater attention given to food and drugs. In 1902, further studies of sewer outlets were inaugurated, and then came work on the Neponset River; in 1905, the antitoxin work was begun, and in 1907, the work of the State Inspectors of Health. These increases were all natural ones, reflecting the application of modern ideas to the problem of public health in Massachusetts. Fig. 3 shows the increase in the expenditures of the Board from year to year. The special expenses for the investigations of the Metropolitan Sewerage, in 1888, and the Metropolitan Water Supply, in 1894, are conspicuous, but not large when compared with the later ones. In what may be called the conservancy functions of the Board, that is, the protection of the food supply and the purity of inland waters, the appropriations have just about kept pace with the increase in population, that is, the per capita appropriations have remained very nearly constant.

Increasing Expenditures

The appropriations for 1913, the last full year of the State Board of Health, were subdivided as shown in the table on the next page.

The ratios between total deaths and population computed annually, known as general death-rates, or crude death-rates,

are commonly taken as an index of the hygienic or sanitary conditions of a community, but by no means do they tell the whole story; they merely indicate general tendencies. Judged by this standard, it is evident from Fig. 4 that since the early nineties there has been a decrease in the death-rate

Crude Death-rates lowered

Item		Amount	Cents per Capita
General Expenses		$26,500	$0.76
Water Supply and Sewerage		55,000	1.57
Purity of Inland Waters	$36,000		
Sewer Outlets and Neponset River	16,000		
Supervision of Water Companies	1,000		
Merrimack River	1,000		
Aberjona River	1,000		
Food and Drugs		29,500	0.84
Inspection of Food and Drugs	17,500		
Slaughtering and Meat Inspection	5,000		
Cold Storage of Food	7,000		
Antitoxin and Vaccine		21,000	.60
Inspectors of Health		38,800	1.11
Investigation of Diseases		10,500	.28
Anterior Poliomyelitis	10,000.00		
Ophthalmia Neonatorum	500.00		
Extermination of Mosquitoes		855	.02
Printing Annual Report		5,000	.14
Balance from 1912		1,514	.06
		$188,669	$5.38

of the state. Naturally there have been fluctuations due to various causes, such as changes in the population, changes in the birth-rate, and the occurrence of outbreaks of particular diseases, but on the whole the improvement in the health conditions has been marked. The decreasing death-rate may be attributed very largely to the development of the science of biology with its germ theory of disease, its aseptic surgery, its antitoxins and vaccines, and its influence on sanitary chemistry and sanitary engineering. Under the stimulus of the State Board of Health the new principles were put into practice. The experts of the Board made scientific discoveries, conceived plans, advised and educated, and in many

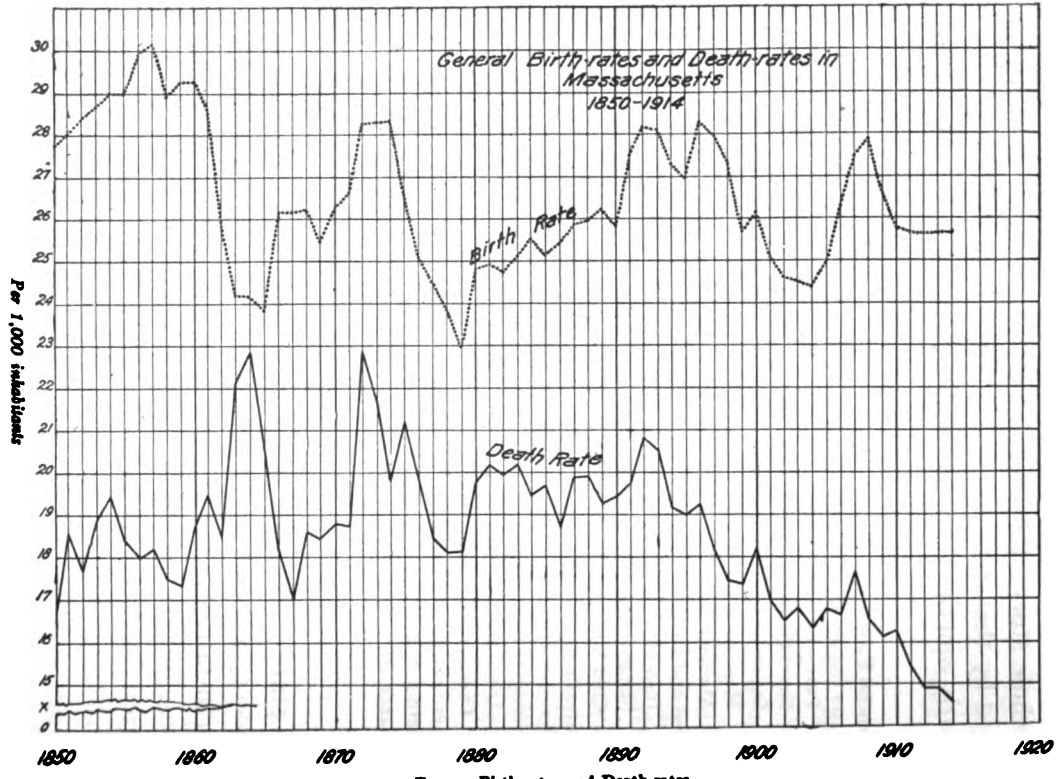


FIG. 4. Birth-rates and Death-rates.

ways secured sanitary reforms and improved the administration of public health.

It will not be surprising if, in the future, the general death-rate of the state increases somewhat. This need not necessarily cause alarm. The present birth-rate is relatively low; a sudden increase in the number of births would increase the number of deaths of children; and, as may be seen from Fig. 4, there are natural correspondences between the birth-rate and the general death-rate, which are especially noticeable in a community where the middle-age groups are kept up by immigration.

A better comparison is that of the specific death-rates for different age periods. This was emphasized by Lemuel Shattuck in his report of 1850, and by Dr. Abbott in his paper reprinted on a later page. Even better than these comparisons are the records for the communicable diseases, three of which may be taken as illustrations: typhoid fever, diphtheria, and tuberculosis. (See Figs. 5, 6 and 7.)

Typhoid Fever reduced

The typhoid fever death-rate in Massachusetts has been decreasing ever since the civil war, for which there have been many reasons. Without question, one of the principal reasons was the improvement in the sanitary quality of the public water supplies. At the time when the State Board of Health was organized the annual death-rates for this disease in some of the cities were well above one hundred per hundred thousand of population, and the average rate for the state was about ninety. By the time that the department of engineering was established, in 1886, the average rate had dropped to half of this figure. Since then the decrease has continued steadily until, in 1914, it had fallen to 7.3 per one hundred thousand. Had the rate which prevailed in 1886 held in 1914, there would have been 162,000 deaths from typhoid fever in the state during the year, instead of 26,000. This is an idle speculation, although not without interest. The differ-

ence of 136,000 lives cannot, of course, be credited to the State Board of Health alone, for the rate would probably have decreased to a considerable extent, even if the Board had never existed — how much, no one can say. But there is every reason to believe that the State Board of Health

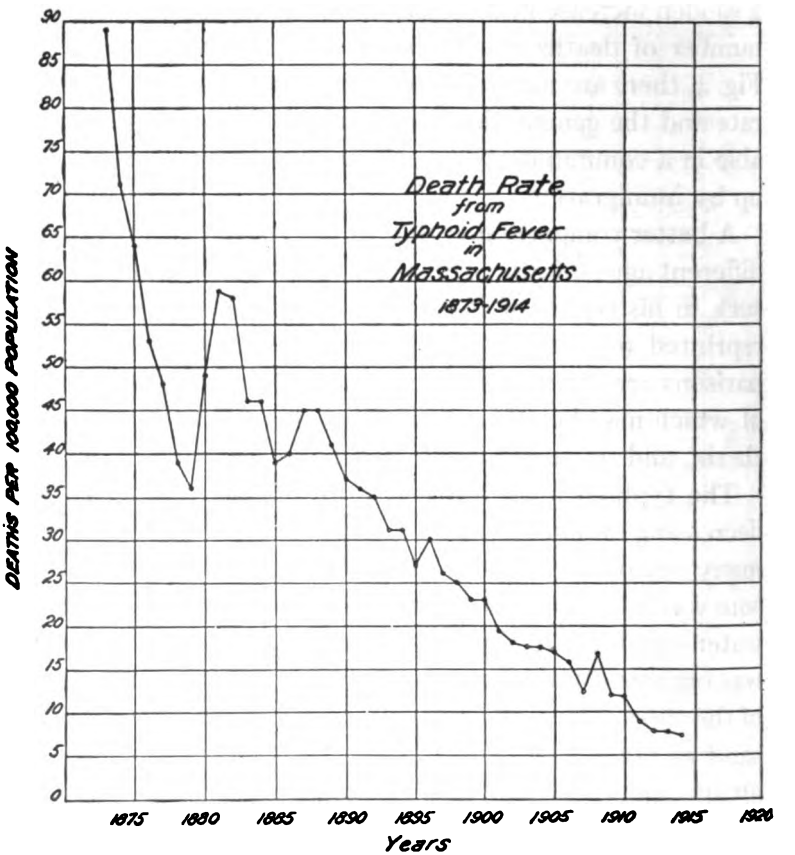


FIG. 5. Typhoid Fever Death-rate.

was a great dynamic force in helping to drive typhoid fever from the state.

Diphtheria reduced

In the case of diphtheria the effect of preventive measures is more definite. Prior to the introduction of antitoxin, this disease swept over the state as a series of waves, which re-

curred at intervals of five or six years. Fig. 6 shows that since 1895 each time the crest of the wave has been lower than the preceding, and each crest followed by a constantly

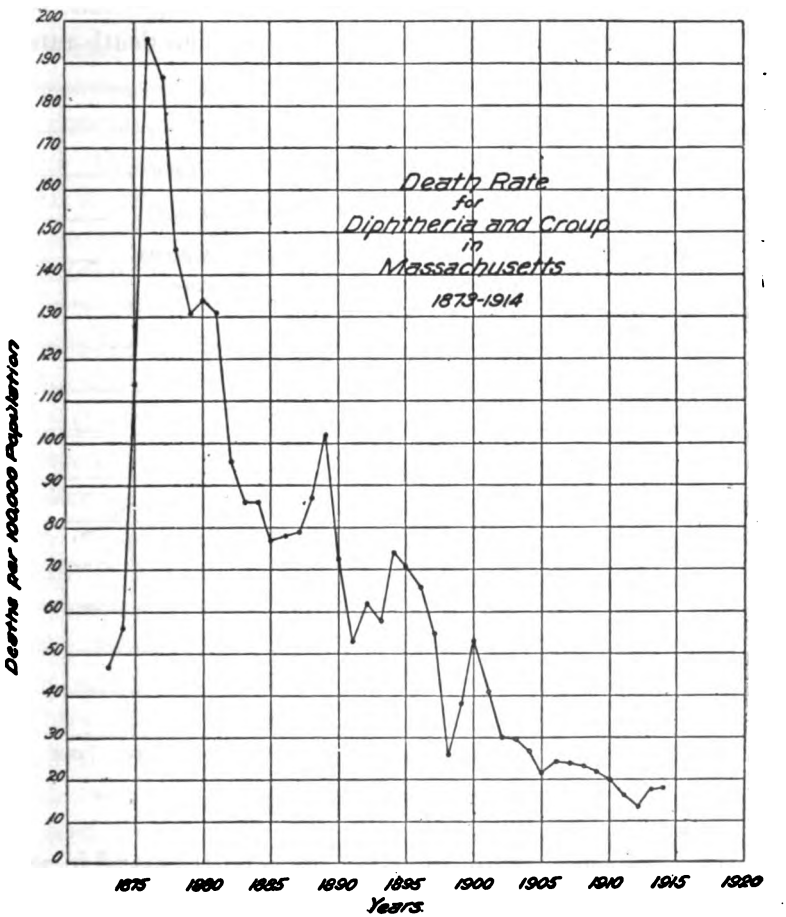


Fig. 6. Diphtheria Death-rate.

lowering trough. A diphtheria wave was due about 1906, but failed to occur, although the rate increased slightly that year and the next. Similarly, another wave was due about 1913, but this also failed to materialize. The highest diphtheria rate since the organization of the Board was a hundred

and ninety-six per hundred thousand in 1876. The contrast between this figure and the lowest rate, fourteen per hundred thousand, in 1912, is most striking and gratifying.

Tuberculosis reduced

Consumption, or tuberculosis of the lungs, has been steadily decreasing for many years. The high death-rate of

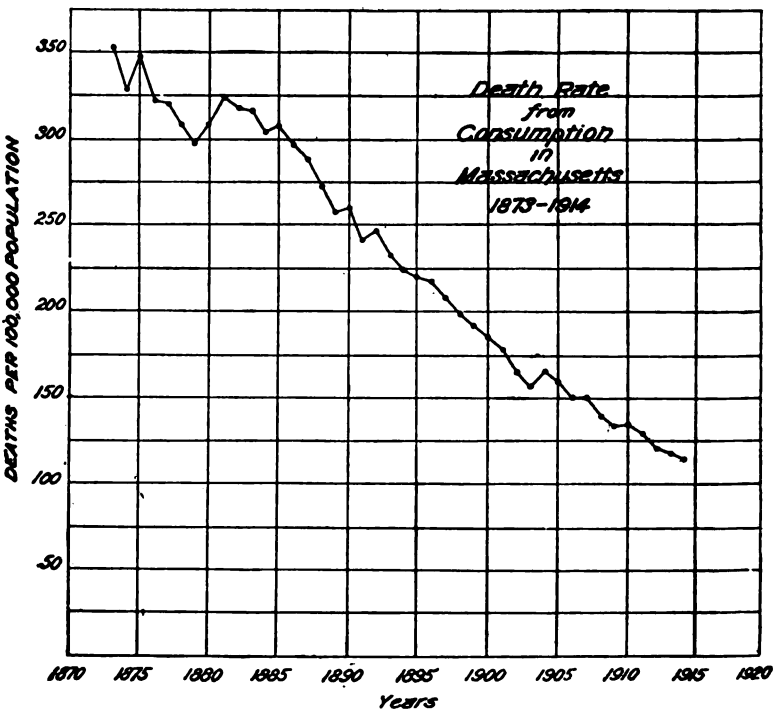


FIG. 7. Tuberculosis Death-rate.

three hundred and fifty-three per hundred thousand in 1873 has gradually fallen until, in 1914, the rate was only a hundred and fourteen per hundred thousand. This also is a matter for great encouragement. If tuberculosis has been reduced two-thirds in less than fifty years, may we not hope that in another fifty years it will almost have disappeared?

It is quite likely that the reductions in the Massachusetts death-rates would have been even greater than those shown

if there had been no immigration of foreign population during the last two or three decades. Many of the new comers to this country have been accustomed to living under unsanitary conditions, and it is only by repeated efforts, both educational and punitive, that satisfactory hygienic conditions can be maintained throughout the state. Increasing density of the population intensifies the need of greater co-operative work. Thus the problem is seen to be a continuing one.

Much money has been spent to reduce the death-rate; more money must be spent to keep it down — no relaxation in sanitation can be permitted. Appropriations for real, effective public health work are not given grudgingly, because it has been learned by experience that such work pays.

Life Saving not the only Work of a Health Department

The work of the State Board of Health cannot be reckoned in death-rates alone. To balance the results of life-saving against the cost of life-saving is one way of looking at the problem and often a very useful way. It enables one, sometimes, to adjust appropriations so that the largest possible number of lives may be saved for a given expenditure. In any community there is much sickness which never leads to death; there are many minor ailments which incapacitate for work, and lead to suffering and misery, brought on by unsanitary conditions in dwellings and workshops, on the cars and in the streets, by poor and insufficient food. We have no reliable statistics by which to estimate these conditions, but we need them sadly. The State Board of Health has not been unmindful of this phase of the subject; an excellent beginning looking towards improved factory sanitation was made, but the work grew so rapidly that it was transferred to another department of the state. It is, however, public health work.

Fresh air, sunlight, and cheerful surroundings are likewise necessary for human comfort and health. If these existed in abundance, some of the other sanitary measures, now neces-

sary, might be curtailed. In providing for such matters, the work of the health department naturally comes into contact with that of park departments and building departments, and the regulation of plumbing, and the like. In all these things we find that the State Board of Health maintained a lively interest. In short, a study of the history from 1869 to 1914 shows a marvelous breadth of view. It has been truly a state board of health — not a state bureau of disease.

Millions spent in Engineering Works

The Metropolitan Water Supply cost forty million dollars, the North Metropolitan Sewerage Works six million, the South Metropolitan Sewerage Works seven and a half million, the Charles River Basin four million; the improvements of the Neponset River and other streams nearly half a million. A total of sixty million dollars has been spent by the state under the general advice of the Board; many more millions have been spent by the cities and towns under its advice, and hundreds of thousands of citizens have received the benefit. The Board has proved a guiding, constructive force in engineering works which have greatly altered and improved the sanitary conditions of the state. The work was wisely planned and well executed, exemplifying a high order of statesmanship.

Fulfilment of an Ideal

The reader is now asked to look back at Lemuel Shattuck's ideal for a state health organization, and compare it with the actual achievements of the State Board of Health. In making this comparison, one is amazed, first, at the far-sightedness of Shattuck, and, second, at the way in which his ideal slowly fulfilled itself; there is hardly one of his fifty recommendations which has not in one way or another been carried out in Massachusetts, and there is hardly a public health measure put into practice which was not anticipated by Shattuck, save only those relating to bacteriology — a science then unborn.

CHAPTER XIII

PERSONALIA

In a retrospect of the labors of the Massachusetts State Board of Health, nothing is more striking than the fact that the great accomplishments were due to the influence of particular individuals, who from time to time were dominant forces in their fields of work. Nowhere do we find better illustration of the general principle that history is, after all, an integration of biographies, with certain names standing out prominently and typifying certain ideas and events.

Influence of Massachusetts Scientists

To appreciate the work and influence of the State Board of Health we should know something more of its men than the few facts brought to view in the chapters which have gone before. We need to discern that the leaders were indeed men of vision, men of education and high scientific attainment, men possessing statesmanlike qualities, men reflecting all that is best in the New England character — men of Harvard College, of the Harvard Medical School, men of the Massachusetts Institute of Technology. We need to observe that the work of these men was not confined to the State Board of Health; many of them had other interests; many of them left Massachusetts to carry on their work elsewhere in the nation. In these graduates the state may justly take pride, realizing that in sanitation, as in all things intellectual, Massachusetts has contributed much to the nation's development.

It has been the good fortune of the writer to know personally, and in many cases intimately, those who have taken part in the work of the State Board of Health since the "eighties," and especially the engineers, chemists, and biologists.

Through the kindness of many friends he has been able to accumulate a series of biographical sketches, which, it is hoped, will inspire students of sanitation to emulate their achievements. A few of these, representing the earlier period, are given in this chapter; the others will be found in the second volume.

The early Agitators

First in the roll of honor should be placed Lemuel Shattuck, the man ahead of his time, the careful student who, from his studies of statistics, acquired a logical imagination which enabled him to outline the scope of a state department of health in such a way that it has hardly yet been exceeded.

When, after a lapse of nearly twenty years, the State Board of Health was established, Dr. Henry I. Bowditch became its first chairman. It is not to be supposed that during these twenty years no one else was interested in the subject. Shattuck's ideas did not take root at once, for in his time there were other and larger issues before the public; among them the great issue of slavery. The war produced sanitary problems of great magnitude, and at its close the methods found necessary in war were seen to be desirable also in times of peace. Many of the physicians of the state, members of the Massachusetts Medical Society, men prominent in local health matters, and women also, were instrumental in obtaining the passage of the act which created the State Board of Health. Their names cannot be given, but it should not be forgotten that there was a body of medical men in the state who co-operated loyally with the officials, and without whose support the movement would have failed.

Among these, the name of Dr. Edward Jarvis stands out conspicuously. Like Shattuck he was a statistician by instinct, and did much to support the idea of state medicine. He left many writings on vital statistics, and these, together with his collected books and reports on the subject, are deposited as a special collection in the Boston Public Library.

The Members of the Board

The following is a list of the members of the State Board of Health in order of their appointment. Members of the Board

State Board of Health

June 30, 1869 — June 30, 1879

Service Began	Name	City or Town	Occupation	Length of Service in Years	Service Ended
1869	Henry I. Bowditch,	Boston,	Physician,	10	1879
1869	George Derby,	Boston,	Physician,	5	1874*
1869	P. Emory Aldrich,	Worcester,	Lawyer,	4	1872
1869	William C. Chapin,	Lawrence,	Manufacturer,	3	1871
1869	Warren Sawyer,	Boston,	Business,	5	1873
1869	Richard Frothingham,	Charlestown,	Historian,	11	1879
1869	R. T. Davis,	Fall River,	Physician,	10	1879
1872	G. V. Fox,	Lowell,	Lawyer,	2	1873
1874	J. C. Hoadley,	Lawrence,	Civil Engineer,	5	1879
1874	Thomas B. Newhall,	Lynn,	Business,	6	1879
1874	David L. Webster,	Boston,	Manufacturer,	6	1879
1874	D. F. Folsom,	Boston,	Physician,	5	1879

State Board of Health, Lunacy and Charity
Committee on Health

July 1, 1879 — May 26, 1886

1879	Henry I. Bowditch,	Boston,	Physician,	1	1879
1879	R. T. Davis,	Fall River,	Physician,	4	1883
1879	J. C. Hoadley,	Lawrence,	Civil Engineer,	3	1882
1880	Alfred Hosmer,	Watertown,	Physician,	2	1882
1880	Thomas Talbot,	Billerica,	Lawyer,	4	1884
1880	George P. Carter,	Cambridge,	Business,	3	1883
1882	Henry P. Walcott,	Cambridge,	Physician,	1	1883
1882	John Fallon,	Lawrence,	Business,	4	1886
1882	Edgar E. Dean,	Brockton,	Physician,	2	1884
1883	Charles E. Donnelly,	Boston,	Lawyer,	3	1886
1883	Reuben Noble,	Westfield,	Business,	2	1885
1884	Samuel A. Green,	Boston,	Physician,	2	1886
1884	Edward Hitchcock,	Amherst,	Physician,	2	1886

* Died in office.

State Board of Health

May 26, 1886 — July 1, 1914

Service Began	Name	City or Town	Occupation	Length of Service in Years	Service Ended
1886	Henry P. Walcott,	Cambridge,	Physician,	28	1914
1886	Hiram F. Mills,	Lawrence,	Civil Engineer,	28	1914
1886	Julius H. Appleton,	Springfield,	Manufacturer,	4	1890
1886	Frank W. Draper,	Boston,	Physician,	15	1901
1886	Thornton K. Lothrop,	Beverly,	Lawyer,		
1886	Elisha M. Jones,	Taunton,	Physician,	7	1893
1886	James White,	Williamstown,	Business,	1	1887
1887	Theodore C. Bates,	No. Brookfield,	Manufacturer,	1	1888
1889	Joseph W. Hastings,	Warren,	Physician,	5	1894
1890	John M. Raymond,	Salem,	Lawyer,	1	1892
1891	Gen. Morris Shaff,	Pittsfield,	Soldier,	2	1892
1893	James W. Hull,	Pittsfield,	Insurance,	9	1911
1893	Gerard C. Tobey,	Wareham,	Lawyer,	9	1911
1893	Charles H. Porter,	Quincy,	Insurance,	8	1911
1895	Julian A. Mead,	Watertown,	Physician,	10	1914
1902	John W. Bartol,	Boston,	Physician,	5	1907
1907	Robert W. Lovett,	Boston,	Physician,	8	1914
1911	Clement F. Coogan,	Pittsfield,	Business,	3	1914
1911	Joseph A. Plouff,	Ware,	Lawyer,	3	1914
1911	C. E. McGillicuddy,	Worcester,	Lawyer,	3	1914
1913	Milton J. Rosenau,	Brookline,	Hygienist,	2	1914

State Department of Health

July 1, 1914 —

Commissioner

1914	Allan J. McLaughlin,	U.S. Public Health Service,	Physician,	†

Council

1914	William T. Sedgwick,	Boston,	Biologist,	†
1914	George C. Whipple,	Cambridge,	Sanitary Engineer,	†
1914	Milton J. Rosenau,	Brookline,	Hygienist,	1914
1914	William J. Gallivan,	Boston,	Physician,	†
1914	David L. Edsall,	Boston,	Physician,	†
1914	Joseph E. Lamoureux,	Lowell,	Physician,	†
1914	John T. Wheelwright,	Boston,	Lawyer,	†

† Present incumbent.

Of the forty-two men who served on the Board between 1869 and 1914, sixteen were physicians, thirteen business men or manufacturers, nine lawyers, two civil engineers, one historian, and one a soldier.

Terms of Service

Dr. Henry P. Walcott had the longest term of service as a board member, twenty-nine years in all, being a member of the Board of Health, Lunacy, and Charity in 1882–1883, and a member of the State Board of Health from the time of its reorganization, in 1886, to its end, in 1914. The service of Hiram Mills was nearly as long, twenty-eight years, 1886–1914. Next in order was Dr. Frank W. Draper, who served for fifteen years, from 1886 to 1901; Dr. Henry I. Bowditch, eleven years, 1869–1879; Dr. R. T. Davis, ten years, 1869–1879, and Richard Frothingham, 1869–1879. Of the others fourteen served for five or more years, and twenty-two for less than five years.

It may be fairly said that in addition to personal qualifications, variety of occupation and long tenure of office contributed much to the breadth and stability of the Massachusetts State Board of Health.

The Chairmen

During its forty years of existence the Massachusetts State Board of Health has practically had but two chairmen, Dr. Henry I. Bowditch and Dr. Henry P. Walcott. Dr. Bowditch served from the beginning until the Board was merged in the Board of Health, Lunacy, and Charity, a period of ten years, while Dr. Walcott served throughout the entire period of the reconstituted board, from 1886 to 1914, twenty-eight years.

Between 1879 and 1886, the Board of Health, Lunacy, and Charity had for its chairmen Moses Kimball, 1879, Thomas Talbot, 1880–1883, and Charles E. Donnelly, 1883–1885. The chairmen of the Committee on Health were Dr. Henry I. Bowditch, 1879, Dr. Alfred Hosmer, 1880–1881, Dr. Henry P. Walcott, 1882–1883, and Dr. Samuel A. Green,

1884–1885. It will be noticed that, even during this period, Dr. Bowditch and Dr. Walcott were chairmen of the Committee on Health for nearly half of the time.

So much is told elsewhere in this history about these two men and their influence upon the public health movement in Massachusetts and the United States that little need be said at this point except to call attention to their work as chairmen. They were both able administrators; both inspired their fellow members; both knew how to manage men; both were able to choose between the best and the mediocre; both were lovers of science. But in many ways they were different: Dr. Bowditch was a reformer, Dr. Walcott was a statesman; Dr. Bowditch knew how to blaze the trail, Dr. Walcott knew how to build the permanent highway.

The Reformer and the Statesman

It takes little money to blaze a trail; it takes a great deal to construct and maintain a permanent highway. The appropriations in the early days were small; " State medicine " then did not have popular support, for its scientific foundation had not been laid. It was during the " interregnum " that the germ theory of disease became definitely settled, and when Dr. Walcott took the helm in 1886, the flood tide was setting in. He showed himself to be so able a pilot that the Legislature did not hesitate to provide ample appropriations. The state officials trusted him, for they realized that the money would be well spent; and they trusted the advice of the Board, because they realized that it was supported by the scientific knowledge of able experts. During the years from 1886 to 1914, Dr. Walcott and his Board spent over two million dollars of the state's money for purposes of public health through the appropriations for the State Board of Health, and made recommendations which resulted in the expenditure of sixty million dollars for the Metropolitan Water Supply, Metropolitan Sewerage, and other public improvements.

Dr. Bowditch was a vigorous writer whose various letters are full of inspiration; Dr. Walcott wrote little over his own signature, but he also was a forceful writer. The general reports of the Board were written by him, and so also was much of the report of the Massachusetts Drainage Commission. The literary style of the two men was noticeably and characteristically different: Dr. Bowditch addressed the general public; Dr. Walcott wrote to legislators, to scientists, and men in authority. The one was picturesque; the other was diplomatic — both were eminently sincere — and the State of Massachusetts owes much to them, though most to Dr. Henry P. Walcott, whose name will go down in history as the great sanitary statesman of Massachusetts.

The Secretaries

The position of Secretary of the State Board of Health has always been one of importance and influence, for the Secretary was the executive officer. Better than anyone else he knew all of the various activities in the field — in fact, in the early days a large part of the work was conducted by him.

The state has been fortunate in its Secretaries. First, was Dr. George Derby, Boston physician, civil war veteran, Harvard professor, forceful and earnest, who served from 1869 until his death in 1874. Then came Dr. Charles F. Folsom, a physician of fine intellect and broad sympathies, popular among the medical fraternity, experienced in the institutional treatment of disease, and with a wholesome appreciation of the relation of the engineer and the chemist to public health interests. He himself made investigations of sewage disposal in Europe, and wrote important reports on engineering matters. Dr. Folsom served as Secretary until the reorganization in 1879 — indeed, he remained as Secretary and executive officer of the Department of Health under the Board of Health, Lunacy, and Charity until 1880.

During the "interregnum," the executive work passed from the hands of the Secretary to the Health Officer, a po-

The Secretaries

sition created after Dr. Folsom's departure, and first held by Dr. Henry P. Walcott. It is said that Dr. Walcott's selection was due largely to Dr. Folsom, a fact which shows that the Secretary was a good judge of men. After serving as Health Officer for about a year and a half Dr. Walcott was made a member of the Board and Chairman of the Department of Health, and Dr. Samuel W. Abbott became Health Officer in his place, a position which he held until 1886 when he was made Secretary of the rehabilitated State Board of Health.

Dr. Abbott's incumbency brings us down to modern times, for he served the state until his death in 1905. Like several of his predecessors, he also obtained early experience in the civil war, and like Shattuck and Jarvis, he was a born statistician and a lover of order in administrative matters. He was an ideal secretary, and for a generation kept the wheels of the machinery of the State Board of Health moving smoothly and swiftly.

Dr. Charles Harrington came to the secretaryship in 1905, after long service as analyst; he was especially interested in the milk problem, and vigorously pursued those who offended against the law of selling milk below standard. When the standard was lowered slightly, he was even more relentless in his efforts. After four years of aggressive service, terminated by his death, he was succeeded by Dr. Mark W. Richardson, a Boston physician, skilled in hygiene, who remained the Secretary of the Board until the present State Department of Health was established in 1914.

The Assistant Secretary

Throughout the history of the Board, the Secretary's office was the centre of activity; all of the reports and official communications were sent out by that officer; and the records and accounts were in his charge. Towards the end, this work became so great that an Assistant to the Secretary was provided, and Dr. William C. Hanson served in this position

from 1907 to 1914, when he was made Acting Commissioner of Health; under Dr. Richardson, Dr. Hanson had charge of a large part of the routine work of the office. The congestion of work in the Secretary's office was one of the reasons which finally led to a change of organization, and brought in a Commissioner of Health and a number of separate departments.

The Engineers

In the early days of the State Board of Health, many prominent engineers, some of them of national fame, were employed for special services. Thus we find the names of James P. Kirkwood, Eliot C. Clarke, George E. Waring, Phineas Ball, J. C. Hoadley, Edward S. Philbrook, E. S. Chesborough, Alphonse Fteley, William Wheeler, and others. J. C. Hoadley was the first engineer member of the Board, serving from 1873 to 1879.

It was the coming of Hiram F. Mills, in 1886, which intensified the engineering work and developed it upon the high plane where it has since stood. For more than a quarter of a century Mr. Mills was the guiding engineer of the State Board of Health. Others held the titles of Chief Engineer and Consulting Engineer, but his hand was always at the helm. When his appointment was made, the time was ripe for undertaking great engineering works in several directions, and it was fortunate for the state that the Board was guided by a man of large ideas, of sturdy integrity, and of painstaking devotion to details. Modest to a fault, exclusive, seldom seen among his fellow engineers in social meetings, he towered aloof, but his work told of the man, and in 1909, he received the high reward of being elected an Honorary Member of the American Society of Civil Engineers. The State of Massachusetts owes much to Hiram F. Mills.

Frederick P. Stearns was the first Engineer to the Board. He was appointed in 1886, after the Legislature had charged the State Board of Health with the care of the inland waters.

He was well equipped for the task, as he had already been connected with the Boston Main Drainage Works and with studies for an additional supply of water for Boston.

The great Work of Mr. Stearns

The work of his department increased with great rapidity, and from small beginnings his office became the seat of the most important activities of the Board. This work is described elsewhere, but in our admiration for the great Metropolitan Works which he designed, we should not forget the engineer himself. Mr. Stearns left the State Board of Health to become the Chief Engineer of the Metropolitan Water Board, in order that he might build what he had already conceived, and he still serves as Consulting Engineer to advise as to the operation of the work whose construction he had planned and executed. Seldom does an engineer have as good an opportunity as he has had to spend his life in close relation to his own monumental work.

Almost from the very beginning X. H. Goodnough was associated with the work of Mr. Stearns. In 1895, he succeeded him as Chief Engineer, serving until 1914, when he became Director of the Division of Sanitary Engineering in the new State Department of Health, retaining his title of Chief Engineer. To a marked degree Mr. Goodnough has upheld the standards and conservative traditions of his former chiefs, Hiram F. Mills and Frederick P. Stearns. One of the most notable works carried out under Mr. Goodnough's directions is that of the improvement of the Neponset meadows.

During the last generation a very large number of assistant engineers have been employed by the State Board of Health. Some of these acquired reputation in the service; many have acquired reputation later. The engineering department has proved a training school, a place in which many graduates from the Massachusetts Institute of Technology and Harvard University "won their spurs." Space permits giving the

Assistant Engineers

names of only those who served for a considerable time or did unusually important work. Arthur T. Safford and William S. Johnson were the principal assistants next to Mr. Goodnough at two important periods, and R. M. Whittet and Edward Wright, still employed in the department, should also receive special commendation.

ASSISTANT ENGINEERS

Name	Date of Employment	Approximate Length of Service in Years
Arthur T. Safford	1887	5
W. W. Locke	1892	2.5
Albert F. Noyes	1893	1.5
Morris Knowles	1893	2
J. N. Ferguson	1894	1
Wallace C. Brackett	1895	2.5
Theodore Horton	1895	1
William S. Johnson	1895	12
E. H. Laws	1895	1.5
Charles Gilman Hyde	1896	4.5
R. R. Bradbury	1898	1.5
F. S. Bailey	1898	5
R. Winthrop Pratt	1898	4
W. L. Butcher	1900	8
Paul Hansen	1902	1
R. M. Whittet	1902	‡
H. E. Mead	1903	3
C. Saville	1904	5
Edward Wright	1906	‡
H. R. Crohurst	1907	7
H. R. Hall	1908	4
M. M. Manning	1910	2.5
H. E. Holmes	1911	‡
A. D. Weston	1912	‡
E. H. Williams	1912	‡
E. H. Gage	1912	3
F. H. Kingsbury	1912	‡
G. W. Bakeman	1914	1.5

‡ Employed at the present time.

The Analysts

In the early days, the State Board of Health drew freely upon the services of professors in Harvard College, the Harvard Medical School, and the Institute of Technology. Among the names mentioned we find those of Frank H.

Storer, the associate of President Eliot when he was at the Institute of Technology; Henry B. Hill, of Harvard; William Ripley Nichols, Arthur H. Nichols, James F. Babcock, Ellen H. Richards, Edward S. Wood, S. P. Sharples, and others. Their work was directed to special problems.

Then came the regularly employed analysts, Dr. Edward S. Wood, Dr. Bennett F. Davenport, Dr. C. A. Goessmann, and Charles Harrington; and finally should be noted the organization of the analytical work in connection with the inspection of food and drugs under Dr. Charles P. Worcester and his successors, Albert E. Leach and Hermann C. Lythgoe.

The work of the analysts was never as spectacular as that of the engineering department, but nevertheless it was faithful, and in some cases brilliant. Dr. Leach, in particular, deserves credit for his scientific improvement of methods of analysis, and both he and Dr. Worcester are deserving of grateful recognition for arduous services heroically performed under bodily infirmities.

The Chemists and Biologists

Among the chemists and biologists who have been chiefly concerned with the study of water and sewage, the names that deserve special mention are those of William Ripley Nichols, Ellen H. Richards, Thomas M. Drown, William T. Sedgwick, Allen Hazen, George W. Fuller, and Harry W. Clark.

Professor Nichol's work was done during the early days, and he was ably assisted by Mrs. Richards. It was Dr. Drown, who, working in co-operation with Frederick P. Stearns, placed the science of water analysis on its present high plane, and established rules for the interpretation of analyses which in the main have stood the test of time. As Mrs. Richards had worked with Professor Nichols, so she also worked with Dr. Drown. To Mr. Hazen is due much of the credit for the work of the Lawrence Experiment Station, for he was in charge during its formative period, and set a pace

which succeeding directors have tried hard to live up to. Mr. Hazen was succeeded by Mr. Fuller, who entered the work as a bacteriologist, and he in turn was succeeded by Mr. Clark, who for the past twenty years has been in charge of

Assistant Chemists

ASSISTANT CHEMISTS

Name	Date of Employment	Approximate Length of Service in Years
H. A. Richardson	1887	12
H. Martin	1887	1.5
I. F. Hyams (Miss)	1887	10
E. H. Farrington	1887	0.3
Joseph W. Ellms	1891	2
L. K. Russell	1888	4
C. H. Tuttle	1890	2
A. H. Gill	1887	2
L. Miller (Miss)	1892	‡
F. B. Forbes	1893	7
E. H. Laws	1895	2
E. F. Badger	1896	4
A. E. Kimberley	1897	1.5
W. G. Waitt	1900	2.5
G. O. Adams	1900	‡
C. P. Moat	1901	0.2
R. E. Dow	1901	5
A. R. G. Booth	1902	‡
A. F. Harkness	1902	‡
A. W. Kimball	1904	10
M. Helpern	1906	4.5
G. G. Russell	1907	‡
L. W. Stickney	1908	‡
David Bloom	1910	4
R. Warren	1913	‡

‡ To date.

the Experiment Station, as well as the Water and Sewage Laboratories at the State House.

Professor Sedgwick was associated with Dr. Drown and Mr. Mills as Biologist to the Board, and under him served several of his students at the Institute of Technology, among whom should be mentioned prominently the names of George V. McLaughlin, who died in his early prime, and Edwin O. Jordan. Associated with Professor Sedgwick and Mr.

Assistant Biologists

Stearns in the study of inland waters were George H. Parker, George L. West, Gary N. Calkins, and Severance Burrage. Associated with Mr. Clark at the Lawrence Experiment Sta-

ASSISTANT BIOLOGISTS

Name	Date of Employment	Approximate Length of Service. Years
E. K. Dunham	1887	1
F. S. Hollis	1888	1.5
George L. West	1889	2.5
Gary N. Calkins	1890	2.5
Albert P. Mathews	1890	0.3
A. F. Shattuck	1891	1
Severence Burrage	1893	2
William R. Copeland	1893	4.5
Daniel D. Jackson	1895	2
Stephen DeM. Gage	1896	18
Luther R. Sawin	1897	5.5
A. W. Walker	1899	4
Earle B. Phelps	1899	3.5
Arthur I. Kendall	1901	1
J. H. Spurr	1907	‡
C. A. Wells	1909	‡

‡ To date.

tion was Stephen DeM. Gage, who served for the long period of eighteen years.

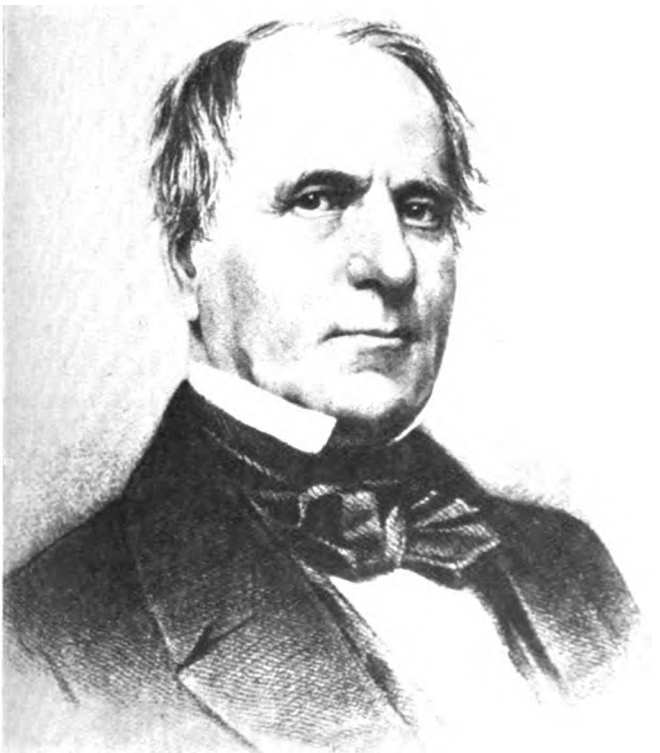
A list of other assistants in the chemical and biological departments who were connected with the work for a considerable time is given in the tables above.

The Pathologists

Dr. Theobald Smith was Pathologist from 1895 to 1914. He was succeeded by Dr. Milton J. Rosenau, the present director of the Division of Biologic Laboratories.

Dr. Herbert R. Brown served in the Antitoxin Laboratory from 1905 to 1916. The diagnostic laboratory at the State House has been in charge of Dr. Ernest L. Walker, Mr. Henry N. Jones, and Miss Edith A. Beckler, the present incumbent.

The following physicians were appointed Inspectors of Health in 1907:



LEMUEL SHATTUCK

The Inspectors of Health

District	Name	Residence
1	Dr. Charles G. Morse,	Wareham
2	Dr. Adam S. MacKnight,	Fall River
3	Dr. Wallace C. Keith,	Brockton
4	Dr. Elliott Washburn,	Taunton
5	Dr. Harry Linenthal,	Boston
6	Dr. Albert P. Norris,	Cambridge
7	Dr. J. William Voss,	Beverly
8	Dr. William H. Coon,	Lawrence
9	Dr. Charles E. Simpson,	Lowell
10	Dr. William W. Walcott,	Natick
11	Dr. Melvin G. Overlock,	Worcester
12	Dr. Lewis Fish,	Fitchburg
13	Dr. Harvey T. Shores,	Northampton
14	Dr. Richard S. Benner,	Springfield
15	Dr. Lyman A. Jones,	North Adams

Subsequently, Messrs. Norris, Shores, and Benner were succeeded by Dr. Frank L. Morse, of Somerville, Dr. John S. Hitchcock, of Northampton, Dr. Herbert C. Emerson and Dr. James V. W. Boyd, of Springfield.

Lemuel Shattuck

Lemuel Shattuck was born in Ashby, Massachusetts, October 15, 1793, and died in Boston, January 17, 1859. From 1794 to 1815, his home was at New Ipswich, New Hampshire. His schooling was that afforded by a district school at a considerable distance from his father's dwelling, followed by two quarters in an academy. In his youth he assisted on the farm, and in the manufacture of yarn, but his first real work was that of teaching school. In 1817, he taught in Troy and Albany, New York; from 1818 to 1832, in Detroit, Michigan. In 1833, he settled in Concord, Massachusetts, and for ten years was engaged in trade, but continued to maintain an active interest in education, being the first to introduce a systematic keeping of school records by the teacher. In 1830, he prepared and published what is said to be the first annual report concerning the condition of a school ever presented in this state.

The First School Report

While in Concord he married, in 1825, Miss Clarissa Baxter, daughter of Honorable Daniel Baxter, by whom he had five children. In 1834, he left Concord and became a book-seller in Cambridge, but soon moved to Boston where he continued his business of selling and publishing books.

Lemuel Shattuck was always interested in public affairs. In 1837, he was a member of the City Council of Boston. In 1838, and again in 1849, he was member of the State Legislature. He must have had a very methodical mind. Studies of history, genealogy, statistics, and public health were his chief avocations. In 1835, he published a history of the town of Concord which has long remained a standing treatise. In 1841, he published a "Complete System of Family Registration," and in 1855, a genealogical study of his own family under the title of "Memorials of the Descendants of William Shattuck." Not content with preparing a mere list of his ancestors, he gave a long description of what he called philosophic genealogy. This was in reality a study of heredity and eugenics, and is well worth reading today. It is a good illustration of his constant endeavor to collect facts and, not stopping there, to analyze them in order to discover causes and prophesy future conditions. His interest in genealogy led him to become a member of the Massachusetts Historical Society in 1830, and a member of the American Antiquarian Society in 1831. In 1844, the New England Historic and Genealogical Society was founded at a meeting held at his house, when he was elected the first vice-president. An oil painting of Shattuck surrounded by the members of his family adorns the walls of the rooms of this society on Ashburton Place.

Philosophic Genealogy

It is interesting to see how Shattuck's interest in genealogy naturally led to a study of vital statistics. In 1839 he assisted in founding the American Statistical Association. In

1837, he devised a plan for arranging, printing, and preserving the Boston city documents. In 1841, he prepared the Municipal Register of Rules and Orders for the City Council, recent ordinances and laws, and a list of the municipal officers of the city of Boston, which was the first publication of its kind in this country. As a result of his propaganda an act was passed which established in 1842 the present Massachusetts system of registration of births, deaths, and marriages, and in 1849, these laws were revised under his direction. He also drew up the law creating the office of city registrar in Boston.

The first Municipal Register

In 1845, he made his sanitary survey of Boston which was published as an official document, entitled "Census of Boston in 1845." In connection with this census he used a new plan of enumeration, that of including the name and description of each person enumerated. In 1849, he assisted in the preparation of plans for the United States Census of 1850. In fact, he drew up the act of Congress which provided for this census.

Census of Boston

Evidently his sanitary survey of Boston opened his eyes to the great importance of public health, for in 1847, the American Statistical Association appointed a committee, of which he was a member, to prepare a memorial to the Massachusetts Legislature urging a sanitary survey of the entire state. The next year the Massachusetts Medical Society joined in this movement, and an act authorizing the appointment of a Sanitary Commission was passed May 2, 1849. Shattuck was chosen a member of the Commission, and in fact, it is not too much to say that he himself was the Commission, for he did the work and wrote the report which was published in 1850. The State Bureau of Statistics of Labor is also an outgrowth of his work.

Sanitary Commission

This brief and fragmentary account of the life of Lemuel Shattuck would be entirely inadequate, were it not for the

long quotation from his report of 1850, which more than anything else reveals the man.

Further details in regard to his life may be found in a memoir written by Charles Hudson in the *Proceedings of the Massachusetts Historical Society* (Vol. 2, page 155) and a biographical sketch published by Dr. Edward Jarvis in the *American Statistical Association*, also in the *Memorial Biographs of the New England Historic and Genealogical Society* (Vol. 3, page 290, 1856–1859). There is also a biographical sketch in the *Shattuck Memorials*, published in 1855, which contains the photograph reproduced on another page.

Dr. Edward Jarvis

The Physician who filled the Gap between Lemuel Shattuck and Dr. Bowditch

Edward Jarvis was born at Concord, Massachusetts, January 9, 1803. He traced his ancestry to John Jarvis, a ship builder, who came from Yorkshire, England, to Boston, in 1661. It was for one of his ancestors that Jarvis Field, Harvard University, was named.

Edward Jarvis was brought up in Concord, and after taking a preparatory course at Westford Academy, entered Harvard College and was graduated in 1826. He held the position of secretary of his class for over half a century.

In 1825, when young Jarvis was in his senior year, his room-mate, who was of a wealthy family, desired to have a carpet on the floor of their room, and offered to pay the whole cost. This was a rare college luxury in those days, as there were not a half dozen in all the rooms of the class. Jarvis wrote to his father, stating the generous proposition of his associate. His father at once wrote back: "I ought not to afford to give you a carpet, but I would not have you tread on a carpet you did not pay for, nor would I prevent your room-mate from having this comfort. You must, therefore, have the carpet, and you pay one-half the cost."

After graduation he taught school in Concord and then studied medicine, receiving the degree of M.D. from the Harvard Medical School in 1830. He practiced in Northfield, Massachusetts, and later in Concord. While in the latter place he came under the influence of Lemuel Shattuck, and soon acquired a love of vital statistics. As in Shattuck's case his fondness for vital statistics grew out of his interest in genealogy. Jarvis was Shattuck's junior by ten years, and not only wrote an account of his life and character, but reviewed some of his Health Reports and other articles. In 1834, Dr. Jarvis married Miss Almira Hunt of Concord.

Dr. Jarvis' Interest in Vital Statistics

In 1834, Dr. Jarvis was appointed professor in the Medical School at Louisville, Kentucky, but differing from the Kentuckians in his views on slavery, he returned to Massachusetts in 1843. He seems to have been much more fond of social studies than of the practice of his profession. He wrote an elaborate article showing the necessity for the establishment of boards of health, boards of charity, hospitals for the insane, and in this way became well known throughout Massachusetts and in New England. After the war, he was engaged by the United States government to work up the vital statistics of the Census of 1860, and this work was done under his direction in Dorchester by a company of young women organized from the public schools of Boston. From this time on, Dr. Jarvis devoted himself largely to social and public health problems. He wrote extensively on many subjects, which may be classified under the heads of physiology, unsanitary properties and conditions of life, sanitary surveys, census reports, and vital statistics.

Dr. Jarvis collected an extensive library of vital statistics, and this collection is now suitably housed in the Boston Public Library. Dr. Jarvis died in 1884.

The following letter written by Dr. Henry P. Walcott to Mr. Alfred Johnson serves to give an idea of the way in which

Dr. Walcott's Tribute to Dr. Jarvis

Dr. Jarvis worked and shows the value of Dr. Jarvis' work to the state, and his influence in the ultimate establishment of the State Board of Health.

Dr. Jarvis had passed from the stage of active work in public health affairs before my long connection with them began in 1880. I am glad, however, to have this opportunity of saying a few words about the services of a man who formed one of a group which in these later days has received less attention from even the interested public than it deserves.

He was one of the great sanitary leaders of his day, especially in that department of the science which alone gives a secure foundation for preventive medicine, that is, a correct body of vital statistics. Massachusetts, as you well know, second only to Great Britain among the English speaking people, established a state system of vital statistics and Dr. Jarvis was one of the active promoters of the legislation which accomplished this result.

At a later date he was chairman of a committee of the Massachusetts Medical Society which enlisted the aid of the medical profession in the preparation of that great report of the year 1850, made by Lemuel Shattuck to the Legislature of Massachusetts, a report which laid out a scheme for the sanitary administration of the Commonwealth which the State has only now been able to accomplish.

It seems to me a sufficient praise for any man of my profession to say that he served in a company of men of the quality of Lemuel Shattuck, Dr. Henry I. Bowditch, and Dr. George Derby, and of these men Dr. Jarvis was an honored and trusted associate.

It will thus be seen that the life of Edward Jarvis fills in the gap between the passing of Lemuel Shattuck and the coming of Dr. Bowditch, Dr. Derby, and Dr. Walcott.

Henry Ingersoll Bowditch [1]

Henry Ingersoll Bowditch, the third son of Nathaniel Bowditch, the mathematician, and Mary Ingersoll, his wife, was born in Salem, Massachusetts, August 9, 1808, but moved with his family to Boston when about twenty years of age.

[1] This biographical sketch was kindly furnished by Dr. Vincent Y. Bowditch, his son.

He studied medicine there, largely under the tutelage of his friend, the famous Dr. James Jackson; and later he spent two years abroad, chiefly at La Pitié Hospital in Paris, under the guidance of the great Louis, and returned to practice in Boston, in 1834. His acquired knowledge in the use of Laennec's stethoscope while in Paris soon brought him to the rank of specialist in diseases of the chest, especially those of the lungs, and his name afterwards was chiefly associated with studies of consumption, its predisposing causes, and methods employed in the treatment of its complications.

An Authority on Diseases of the Lungs

His strong persistent advocacy and his use for years of aspiration in pleuritic effusions by means of the suction pump, trocar, and cannula — a method devised in the early fifties by Dr. Morrill Wyman of Cambridge — were the means of his becoming prominent in this specialty. The invention and use of this instrument preceded by several years that of Dieulafoy's excellent aspirator, which is in principle the same as that of his forerunner but of more convenient construction. His first paper on this subject appeared in 1852.[1]

Soil Moisture and Consumption

His next important contribution to the history of medicine was his exhaustive article upon " Soil Moisture as a Cause of Consumption," published in the *Transactions of the Massachusetts Medical Society* in 1862, with the title " Consumption in New England." This work was accomplished after eight years of investigation at the suggestion, in 1854, of the Massachusetts Medical Society. By these researches he came to the conclusion that living where the ground is damp is an aid to the development of consumption (now usually spoken of as " advanced pulmonary tuberculosis "), and that the converse is true: viz., that living where the ground is dry is a hinderance to the development of the disease.

[1] *American Journal of the Medical Sciences*, April, 1852; *American Medical Monthly*, January, 1853; *Boston Medical and Surgical Journal*, May 25, 1857.

In his comment upon the reasons for these facts, he says in his pamphlet, " How such effects are produced I do not pretend to explain. I am inclined to believe the explanation will remain long, if not forever, among the arcana of which so many exist in our apparent knowledge of the causes of disease."

It is worthy of note that at exactly the same period, Dr. George Buchanan in England was arriving at precisely the same conclusions, the fact that they both were working in the same direction not being known to either until after their articles had been published. The discovery, twenty years later, by Koch, of the specific germ of tuberculosis does not seem to have weakened the force of these investigations, for the importance of residence in dry sunlit houses with proper drainage of the soil, as a prophylactic, is as apparent now as before Koch's discovery.

Largely as a result of these researches and his often reiterated opinion that the state should undertake similar investigations in all diseases, a committee of the House of Representatives reported April 2, 1866, that it was expedient to establish a "State Board of Health." Largely through the efforts of his friend, Honorable Thomas H. Plunkett of Pittsfield, Massachusetts, in the Legislature, and Mrs. Plunkett through other sources, the Legislature voted in 1869 to establish a State Board of Health.

Efforts to establish a State Board of Health

The first meeting was held September 15, 1869, and Dr. Bowditch was elected chairman. From that time until 1879, when the most unwise merging of the Health Board with the three Boards of Health, Lunacy, and Charity was inaugurated, the Board was a unit, for although some differences of opinion at times occurred naturally, a unanimous report was always sent to the Legislature.

Dr. Bowditch's first address to his colleagues can be read in the reports of the Board. Its breadth of vision and high

tone can be gathered by a notice which appeared soon afterwards in the *Gazette Médicale de Paris*.[1]

Intemperance

During his term of service, in 1871, he issued another work, entitled, " Intemperance in New England and How Shall We Prevent It ? " This paper was again the result of several years' investigation of the customs in different countries of the world, as to the use of light wines, beer, and liquors. Basing his opinion upon the replies received from innumerable sources, he declared that the use of light wines and beer in moderation was not seriously detrimental, and that total prohibition was not advisable, even going so far as to say that it would be advisable to advocate the substitution of beer and light wines for liquors, inasmuch as a natural craving for stimulant among human beings would be thus met without serious detriment to health. Whether he would have modified these views toward favoring prohibition in later years, it is impossible to say, although his inclinations were always toward very moderate use of any alcoholic stimulant whatever. His position on this matter at the time brought forth a torrent of abuse from Prohibitionists, one popular preacher going so far as to announce a lecture entitled, " Dr. Bowditch and Free Rum," an amusing episode to all who knew him upon whom the attack was launched.

Preventive Medicine

In 1874, he published another article for the *Fifth Annual Report*, entitled, " Preventive Medicine and the Physicians of the Future." After an extensive review of the grand scope of preventive medicine, he gives his reasons for placing before the public a brief history of events relative to the subject in Massachusetts, as follows:

First, because I want to show the degradation into which sanitary science will be drawn if it once falls into the vortex of political parti-

[1] " Le mois dernier on a fondé à Boston un comité de santé publique sous la présidence du docteur Henry Bowditch. Celui-ci, dans son discours inaugural, a tracé tout le programme que la propose le nouveau comité. Ce programme est trés remarquable, par son étandue et par sa haute portée."

sanship, and I thus present Massachusetts as a warning to other states to avoid such a danger. Harvard alumni are in every state, and each man may do something to prevent such a catastrophe as has been here narrated.

Second, I confess that I have wanted to show the Nemesis that has seized on all these pretenders to the sacred calling of "state preventive medicine" in our State, inasmuch as, for their misdoings, they have been at length hurled from power. This sentiment may be unchristian, but it is human; and all "pertaining to humanity" ought to have the right to claim some response from a Harvard alumnus.

Address before the Medical Congress

In 1876, doubtless in consequence of his connection with the Massachusetts Board of Health and his known predilection for matters relative to sanitary science, he was invited to give an address upon "State Medicine and Public Hygiene in America" at the International Medical Congress in Philadelphia. This involved an immense amount of labor in gathering details from all over the United States relative to conditions of sanitary science. The result made an impression very far from favorable as to conditions in the United States, but the paper was received with enthusiasm and resolutions were taken at the meeting that copies of the address should be sent to the Governors of the various states and territories in the United States, and to Canada. In picturesque language he describes his sensations before delivering the address:

After working many months, I felt that I had gained one point; viz., of showing our utter neglect of everything like state preventive medicine. I felt that I had a truth, which, unpalatable as I supposed it would be to most of my hearers, must be told. "You have got to hear this, my friends," thought I, "so help me God!" Judge of my surprise when the above resolutions were offered — the first by Dr. Atlee on the day the address was delivered, and the last two on the succeeding day. I indeed felt gratified, but my innermost thought was of thankfulness that I had been called thus to strike a blow in behalf of the sacred cause of preventive medicine.

Another honor was conferred upon him in 1879, shortly before his resignation from the Massachusetts Board, in his appointment by the President as one of the first members of a National Board of Health under the provisions of the Act of March 3, 1879. He took the deepest interest in the workings of this Board, but his state of health at the time compelled him soon to resign his position. In October, 1879, he writes of the " magnificent sanitary work of the National Board in keeping the yellow fever almost entirely confined to Memphis although nearly 300,000 people fled from the city." This was, of course, long before the discovery of the transmission of yellow fever by mosquitoes. National Board of Health

A letter, written in 1882 to Dr. A. W. Bell for publication in the *Sanitarian*, gives his views in regard to national and state sanitation. He writes: " The genius of our institutions necessarily requires that power should reach from the highest official down, if need be, to the humblest personage or homestead in the land. When there is a perfect health organization of the nation, we should have, 1st, a National Board of Health; 2nd, a State Board of Health in every State; 3rd, County Boards in every State; 4th, City or Town Boards in every State." . . . He also suggests that in any future National Board the Surgeon General of the United States Army should be *ex officio* one of its members, with a seat in the United States Cabinet. The details mentioned in this letter are too many to be presented here. They are given in full in his biography and are of great interest as showing his thorough grasp of this subject and of his desire to spread the knowledge of sanitation far and wide throughout the nation.[1] Organization of Public Health Boards

His resignation from the Massachusetts Board in 1879, after ten years of faithful service, due to the introduction of

[1] " Life and Correspondence of Henry Ingersoll Bowditch," by Vincent Y. Bowditch, vol. II, pp. 245–250. Houghton, Mifflin Co., Boston, 1902.

politics which hampered the work of the Board, is best told in his own words written in his journal in after years:

In 1878 came mutterings of political disaster to the ruling powers, and forebodings of what the renowned General Butler would do with the numerous " commissions " (that of health among them) that were " spending wastefully the people's money." Accordingly, to attack this redoubtable General upon his political " flank," the legislature, under suggestions from Governor Talbot, merged the three departments of Health, Lunacy, and Charity, a Cerebrus, in fact, in its grotesqueness of head. Three commissions, all different in ideas and modes of action, jumbled into one heterogenous mass, simply because the ruling party feared the advent of power of a political adventurer! The prospects were chilling in the extreme to me, and I soon found two sad results; viz., heartburnings and jealousies among the increased number of members, and an almost total neglect of sanitary work. At one time, for three or four successive meetings, nothing was done about sanitation, the time being occupied in discussions on lunacy and charity, on both of which subjects, so far as they had relation to the State, neither I nor my comrades on the old board knew anything. Such neglect of that which we had been for years laboring for was distressing. I appealed in vain for a return to the single board. Political demagogism was rampant, and our efforts were fruitless; and finally, as a solemn protest against the absurd and fatal combination, I resigned, after months of fruitless effort to persuade a change.

Thus ended Dr. Bowditch's active participation in the work of the Massachusetts State Board of Health. His interest in all public sanitary work continued, however, nearly up to the time of his death, which occurred on January 14, 1892, at the age of eighty-three, after a lingering illness of several months.

What the United States owes to the work of Dr. Bowditch and his associates on the Massachusetts Board of Health — the first to be established in America, and the first to point the way for subsequent similar associations now formed throughout the Union — can never be estimated. Their names will stand pre-eminent in the history of Preventive Medicine in the United States.

Dr. George Derby

Dr. George Derby, who was the first Secretary of the Massachusetts State Board of Health, was born in Salem, Massachusetts, in 1819. He was the son of John Derby, a merchant of that city. He was graduated from Harvard College in 1838, and took his degree from the Harvard Medical School in 1843. For many years he practiced in Boston, and was little known by the public or to the profession until his latent energy and admirable character were brought to light during the Civil War. Early in the war, he went into the field as surgeon of the 23rd regiment of Massachusetts infantry, in which he served with distinction until the end. He had taken special lessons in practical surgery from some of the most eminent surgeons, and was therefore well qualified to undertake this work. He is said to have been fearless in the presence of danger, performing important operations on the field while under fire, with coolness and deliberation, when others, superior to him in authority, shrunk from the ordeal to which his sense of professional duty summoned him.

Dr. Derby in the Civil War

He left the service broken in health, and the government, fully appreciating his worth, and desirous of aiding him in his perfect recovery, appointed him to the charge of the National Soldiers Home at Augusta, Maine. After returning to Boston, he was appointed surgeon to the City Hospital and made Professor of Hygiene in Harvard College. In 1866, he began to edit the registration reports of Massachusetts, and continued to do this until his death. These publications, as well as his own, acquired reputation at the State House and abroad, and pointed to him as the person most fitted to be Secretary of the State Board of Health when it was established in 1869. In fact, it is said that he had no rival for this position. He was an important factor in the early work of the Board, and by his labors placed the community under

Dr. Bowditch's Tribute to Dr. Derby

deep obligations to him. Dr. Bowditch, the Chairman of the Board, wrote at the time of his death as follows:

> We remember his genial and commanding presence; his indefatigable zeal in everything that was ordered by the Board. We were sure of him, as the most reliable person we could have. How much the present position of the Board, as a motive-force in the community, depends on his really wonderful faculty of meeting and of moulding men, we shall never exactly know. For my own part, words would fail me to give my idea of the debt we owe to him. He guarded our honor and safety with so jealous a care that sometimes I was inclined to think him unduly cautious. I never had any forebodings in regard to the safety and ultimate success of the Board, for I believe that State, or Preventive Medicine, has taken so deep a root in the conscience of the English-speaking race, that hereafter, boards of health, or in other words, boards for the prevention of disease, must forever exist; and they will have more and more weight upon the policy of states and of nations, as well as upon the private habits of individuals.

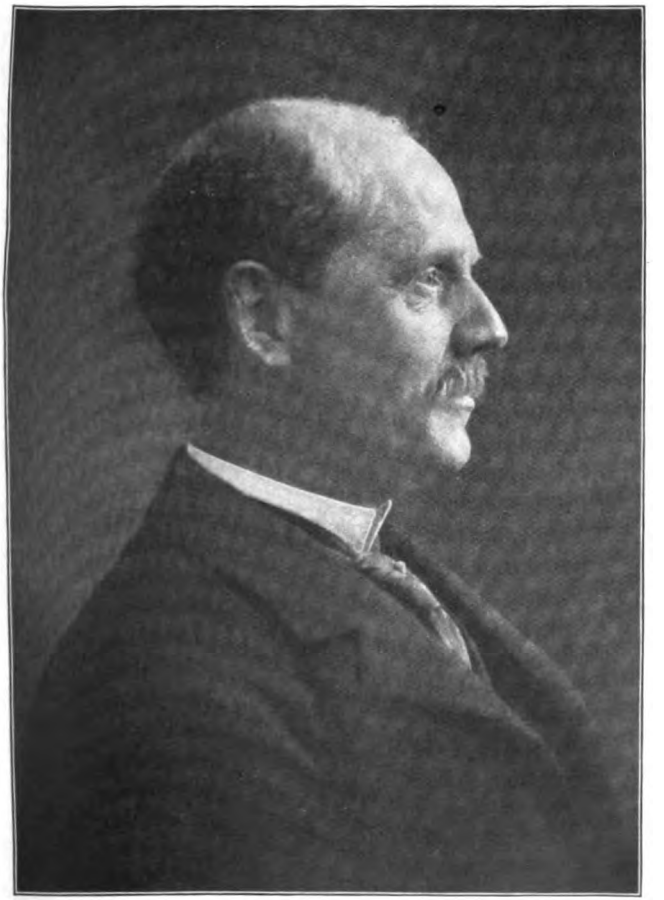
Harvard Professor

From 1867 to 1871, Dr. Derby was a lecturer in Harvard University, and from 1871 to 1874, he was Professor of Physiology and Hygiene in the Medical School.

During the war, he married Miss Parsons, a granddaughter of the celebrated Theophilus Parsons, formerly Chief Justice of the Supreme Court of Massachusetts. He left a wife and two children. His death occurred on June 20, 1874.

Dr. Charles Follen Folsom

Dr. Charles Follen Folsom was born in Haverhill, Massachusetts, April 3, 1842. He was the fifth of eight children. Both of his parents were natives of Portsmouth, New Hampshire. His father was a Unitarian minister, who after some years of pastoral work in New England was appointed, in 1849, to a professorship in the theological school at Meadville, Pa. It was there that the boyhood of Dr. Folsom was mainly spent. He attended Phillips Exeter Academy and Harvard College, where he was graduated with his class in



CHARLES FOLLEN FOLSOM, M.D.

1862. Dr. Folsom would have enlisted in the army but for the solicitations of his parents. An older brother was living in the South and had been drafted into the Confederate ranks, and they could not bear the thought of their two sons meeting upon opposite sides. Instead of entering the army, Dr. Folsom helped to organize the enterprise in behalf of the freedmen at Port Royal, and was sent to the Island of St. Helena where he remained for two years. This was a difficult task for untried philanthropists, but it was well done. Unfortunately, Dr. Folsom's health suffered during this enterprise, and after his return to Boston, in 1865, he took a long voyage around the Horn to San Francisco. In 1866, he decided to study medicine. At that time the old custom of supplementing one's classroom studies by services as an assistant in the private office of an established practitioner was still followed, and Dr. Folsom was fortunate enough to serve in this way Dr. Henry I. Bowditch, who a year later became the first chairman of the State Board of Health. In a letter to Mr. Gannett, written in October of that year, he said, " Dr. Bowditch is simply splendid. He is one of the purest minded men I ever knew and the opportunities for study are very great." Dr. Bowditch apparently held an equally high opinion of his assistant, and it was through him that later he became secretary of the Board and still later followed Dr. Bowditch as a member of the National Board of Health.

Dr. Folsom Assistant to Dr. Bowditch

In 1869, Dr. Folsom served in the Boston City Hospital, and afterwards in the Carney Hospital and the McLean Asylum. In 1873, he went abroad to study asylums, as he believed that it would be his special work in life, but while in Europe he learned of the death of Dr. George Derby, and that Dr. Bowditch had determined upon him to be Secretary in his place.

Dr. Folsom's work as secretary is described elsewhere, but special mention should be made of his investigations con-

nected with public water supplies, sewage disposal, vital statistics, and, above all, diseases of the mind. He took an active interest in the sewerage problem of the city of Boston, and was a member of the special commission consisting of E. S. Chesborough, Moses Lane, civil engineers, and Dr. Folsom, who stood for the interest of public health. The investigations of this commission necessitated a trip to Europe, as a result of which he became one of the authorities on the subject of sewage disposal.

Overseer of Harvard College

Besides his official duties as Secretary of the State Board of Health, he was connected with the Harvard Medical School from 1887 to 1888, serving as a lecturer on hygiene, and finally became an assistant professor of mental diseases. In 1891, Dr. Folsom was chosen an overseer of Harvard College, a position he held for twelve years.

In 1879, he was appointed a member of the Yellow Fever Commission, and at the time of the great epidemic visited Memphis and New Orleans. This yellow fever epidemic formed an occasion for the establishment of the National Board of Health, of which Dr. Bowditch was appointed a member. On his retirement in 1882, Dr. Folsom was chosen as the latter's successor. The work of the National Board died through lack of proper support, but it served to bring Dr. Folsom into wider notice among public men.

Besides serving the state, Dr. Folsom gave much time during the early eighties to the Danvers Lunatic Hospital. He was an expert in mental diseases, and took a prominent part in the public discussion in regard to the insanity of Gateau, assassin of President Garfield.

Dr. Folsom was for many years a visiting physician to the Boston City Hospital, and this brought him into contact with many of the local physicians.

In the spring of 1886, Dr. Folsom married Martha Tucker Washburn, sister of his classmate, William T. Washburn,

and this fortunate union filled with happiness and serenity the remainder of his life. His home gave new scope to his hospitality and his strong social instincts, and their table became well known as one where good talk and good fellowship and good humor, in the best sense, were to be found. Dr. Folsom had had a wide experience with men, with books, and with affairs. He had a good memory, a good sense of humor, and a fondness for a good story, as well as the capacity to tell one, characteristics which, combined with his real love for his fellowmen, made him a highly acceptable companion. The grip that he had upon his friends was shown by a testimonial of nearly seventy of his friends and patients who, wishing to express their grateful appreciation of Dr. Folsom's unfailing care and skill as a physician and their admiration for him as a man, presented Harvard University with a fund of ten thousand dollars for the establishment in the Medical School of the Charles Follen Folsom teaching fellowship in hygiene or in mental and nervous diseases. Dr. Folsom died on August 20, 1907.

Teaching Fellowship established in his Honor

Dr. Henry Pickering Walcott

It is too early to write the life of Dr. Henry Pickering Walcott. The story of a life which has so many sides cannot be described by one who has known but one of them, namely, his work in public health. It needs another biographer to speak of his work as Chairman of the Board of Trustees of the Massachusetts General Hospital, another to speak of his work as a member of the Corporation and twice acting President of Harvard University, another to tell of his work as Chairman of the Metropolitan Water and Sewerage Board, another to tell of his interest in general science, and still another to tell of the man himself. These stories though interwoven would not be complete, for his work is not yet finished. He is still actively engaged in all

Dr. Walcott's many Interests

of the interests mentioned save that of the State Board of Health, which no longer exists under that name.

New England Ancestry

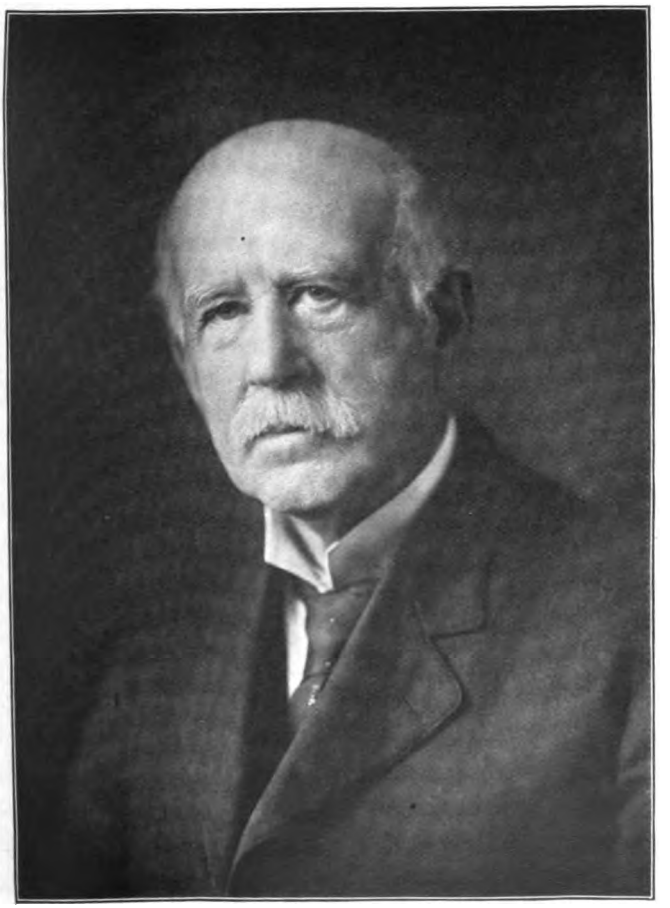
Dr. Walcott was born at Hopkinton, Massachusetts, December 23, 1838, being the son of Samuel Baker Walcott and Martha Pickering Walcott. Early in his life the family moved to Salem where he was fitted for college in the Fiske Latin School under Mr. O. Carlton.

Dr. Walcott was graduated from Harvard College in the class of 1858. He studied medicine in Cambridge with Dr. Morrill Wyman and Dr. Jeffries Wyman and also with Dr. John Ware, and attended the Medical Schools at Harvard and Bowdoin, receiving the degree of M.D. from the latter institution in May, 1861. He then went to Europe and studied medicine in Berlin, Vienna, and Paris. Returning to the United States in 1862 he located in Cambridge and began the practice of medicine, which practice he maintained for many years. His home is still in Cambridge on Waterhouse Street, near Harvard College.

On May 31, 1865, Dr. Walcott married Charlotte E. Richards, daughter of Reuben Richards. Mrs. Walcott died January 26, 1879. Two of their three sons are now living, George Walcott and Robert Walcott, Esq.

Boylston Medical Prize

In 1870 Dr. Walcott received the Boylston Medical Prize for an essay on "Aphasia." He took a keen interest in public health matters in Cambridge, serving as a member of the Cambridge Board of Health and City Physician between the years 1878 and 1891. In 1879 he was a member of a Commission which reported upon the water supply of the city of Cambridge. In 1880 Dr. Walcott was appointed Health Officer to the State Board of Health, Lunacy, and Charity. He resigned this position in November, 1882, and was immediately appointed a member of the Board and Chairman of the Committee on Health. When the State Board of Health was reorganized in 1886 Dr. Walcott was



HENRY PICKERING WALCOTT, M.D.

elected Chairman of the Board, a position which he held until the Board was legislated out of existence in 1914.

His Work for the State

Dr. Walcott has served the state in other capacities. He was a member of the Metropolitan Drainage Commission and of the Commission appointed to report upon the pollution of the Blackstone River. In 1885 he was made Chairman of the Board of Civil Service Examiners of the state. In 1896 he was appointed a member of the Metropolitan Water Board and at the present time is Chairman of the Metropolitan Water and Sewerage Board.

His Work for Harvard

Many know Dr. Walcott best for his services to Harvard University. In 1886 he was Chairman of the College Committee on Athletics. He was elected an Overseer in 1887, and since 1890 has been a Fellow of the Corporation; he is now the senior member of that body. Twice during the absence of President Eliot he acted as President of the University. In 1914 he was honored with the presidency of the Harvard Alumni Association.

Dr. Walcott was elected a trustee of the Massachusetts General Hospital in 1892 and since has been President of the Corporation and Chairman of the Board of Trustees. He was one of the incorporators of the Cambridge Hospital and is now the President of the Board of Trustees.

Dr. Walcott has been a member of many of the leading medical societies. He was President of the Massachusetts Medical Society in 1896 and 1897, and of the American Health Association in 1886. He is a member of the Association of American Physicians and was once its Vice-President. He was one of the founders of the Massachusetts Association of Boards of Health and was President from 1890 to 1913. He is an honorary fellow of the Royal Sanitary Institute of Great Britain. Perhaps the highest honor ever paid to Dr. Walcott was that of the presidency of the Fifteenth International Congress of Hygiene and Demography which met in Washington, D.C., in 1912.

Dr. Walcott's interests have extended beyond the range of medical and public health work. He is a member of the Board of Trustees of the Carnegie Foundation at Washington, and a member of the Massachusetts Historical Society as well as the New England Historical and Genealogical Society. He was President of the Massachusetts Horticultural Society from 1886 to 1889, and again in 1899. In 1915 he was elected President of the American Academy of Arts and Sciences.

In 1907 the degree of LL.D. was conferred upon him by Yale University.

At the time when Dr. Walcott was about to retire as Chairman of the Massachusetts State Board of Health there was presented to him by Dr. George C. Shattuck the following memorial:

Memorial to Dr. Walcott from Two Thousand Physicians

To Henry P. Walcott, M.D., LL.D., Chairman, Massachusetts State Board of Health; from Twenty-two Hundred Members of the Medical Profession of the State, — Greeting.

Sir:

On the 19th day of May, 1914, your term as a member of the State Board of Health ends, and we understand you are not a candidate for reappointment.

Such an occasion cannot be allowed to pass unnoticed, at least by those citizens who as a class should be most competent to gauge the value of such services to the State as yours have been.

The best appraisal of those services is the mention of some of them, with a brief statement of your relations to the Board.

Your connection with the Board began in 1880, 33 years ago, when, after ten years of independent existence, it had been merged with the conjoined Board of Lunacy and Charity, and you were unanimously elected its Health Officer. At this time, you served on a commission for the sanitary improvement of the Blackstone River, a precursor of your subsequent labors on similar problems.

In 1886, by an act of the legislature, the Board of Health once more entered upon an independent existence. You were appointed a member for a seven years' term by Governor Robinson, a Republican, with the advice and consent of the Senate, and became the chairman. You

have since been reappointed three times for terms of seven years; once by Governor Russell, a Democrat, in 1893; once by Governor Crane, Republican, in 1900; and once by Governor Guild, Republican, in 1907. Since 1886, you have always continued as chairman of the Board.

Memorial to Dr. Walcott

Early in 1894, you began to consider the advisability of establishing a laboratory for the free production and distribution of diphtheria antitoxin; and such curative serum was actually distributed early in 1895, being the first so distributed in any state. This was made possible through co-operation of Harvard University, secured by your influence, at the Bussey Institution, and was carried on for nine years — during this time as well as later under the personal direction of Dr. Theobald Smith — until 1903, when the legislature enacted a law authorizing the State Board of Health to produce and distribute antitoxin and vaccine virus. Again through your influence, a laboratory was built on the grounds of the Bussey Institution where the preparation of antitoxin and animal vaccine was carried on together.

Within the last four years, you have served as chairman of two state commissions appointed to consider various important tuberculosis problems: one in 1910, and one in 1912. Reports were made to the legislature and printed as public documents.

It is impossible to separate your work in connection with the Board of Health from that in connection with the North and South Metropolitan Sewerage Systems, the Charles River Valley System, the Charles River estuary improvement, the Metropolitan Water Supply, and numerous other similar problems of perhaps secondary importance, such as the improvement of the Neponset River Valley, of the Concord and Sudbury Rivers, of the sanitary conditions as respects water supply, sewerage, and sewage disposal of many cities and towns which have been devised by the committee on water supply and sewerage of the Board of Health, of which Mr. Hiram F. Mills is chairman, and carried out in connection with its recommendation under your chairmanship of the Board.

Since the re-establishment of the State Board of Health in 1886, under your chairmanship, it has been the custom of the legislature to refer all important sanitary questions to that Board for investigation and advice, instead of creating special commissions, as obtains in many states. This custom, under your wise administration, has doubtless saved much money to the State and, at the same time, secured sanitary improvements recognized in all civilized countries as the best of their class.

The investigations and recommendations of the Board have commended themselves to the legislature and in general have been carried out ultimately as presented.

From 1886 to the present time, you have been constantly and steadfastly facing these great and grave problems. Since 1895, when the State Board of Health made its report to the legislature, presenting a plan for the water supply of the City of Boston and the surrounding cities and towns, have been added to your responsibilities those of a commissionership on the Metropolitan Water Board. You have borne the responsibilities both of recommendation and of execution. . . .

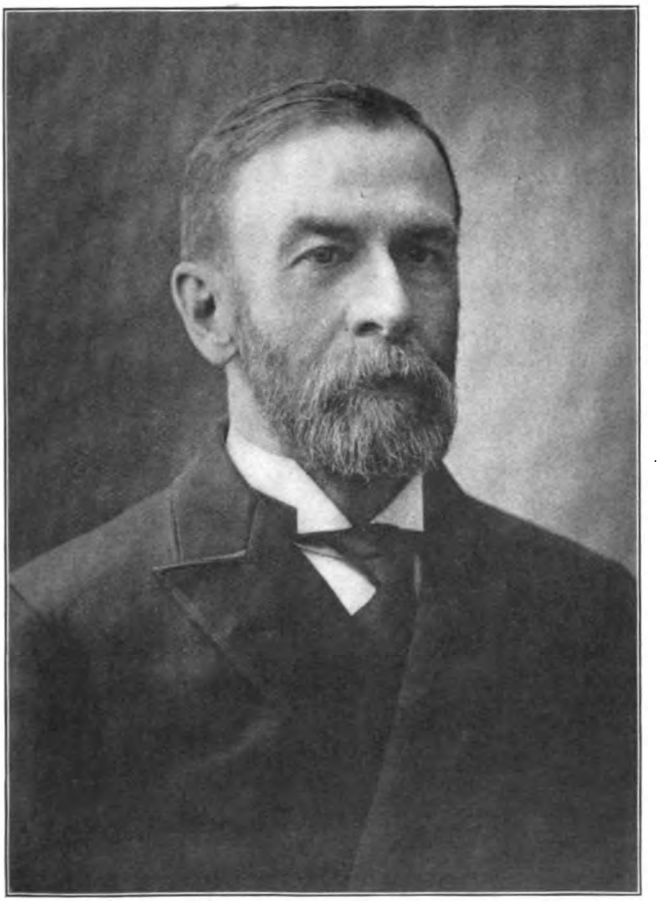
You have met the responsibilities then assumed with such wisdom, discretion, and rare modesty, as to make the task of your successor who would uphold the standards bequeathed to him a difficult one indeed.

The present volume is to a large extent a memorial of Dr. Walcott's work. It is this fact together with the thought that some day a more complete biography of Dr. Walcott must be written that has led the present writer to confine this review of his life to what would otherwise be a most inadequate biographical sketch.

Dr. Samuel Warren Abbott

Dr. Samuel Warren Abbott was born June 12, 1827, at Woburn, Massachusetts. He was of colonial ancestry, his grandfather and both of his great grandfathers taking part in the Battle of Lexington. His father was Captain Samuel Abbott and his mother, Ruth Winn. After attending the public schools in Woburn he went to Warren Academy and later to Phillips Academy in Andover, from which he was graduated in 1854. He then entered Brown University at Providence, and in 1858 received the degree of A.B. He attended the Harvard Medical School, and was graduated in 1862. This was during the Civil War, and even before he received his degree, Dr. Abbott entered the service of his country as Assistant Surgeon in the navy. One of the

Another Civil War Veteran



SAMUEL WARREN ABBOTT, M.D.

notable engagements in which he took part was that of the monitor *Catskill*. In 1864, he resigned from the navy and was appointed Surgeon to the First Massachusetts Cavalry, remaining actively engaged with this regiment until the end of the war. He was with the Army of the Potomac in the Petersburg Campaign, and was mustered out of service in July, 1865.

Between 1865 and 1869, he practiced his profession in Woburn. Between 1869 and 1902, he resided in Wakefield, and after that, up to the time of his death, lived in Newton Centre. While in Wakefield he held the position of Coroner of Middlesex County from 1872 to 1877, and Medical Examiner from 1872 to 1884. He also served upon the school committees and boards of health in both Woburn and Wakefield, and upon the sewerage commission of Wakefield.

On January 7, 1864, he married Miss Martha W. Sullivan of Boston, and at the time of his death she and four children survived him, one son and three daughters.

In 1882, Dr. Abbott was appointed Health Officer of the Board of Health, Lunacy, and Charity, succeeding Dr. Henry P. Walcott in this position. In 1886, when the State Board of Health was reorganized, Dr. Abbott became acting secretary and executive officer, a position which he held until his death in 1904 — twenty-two years in all. His previous experience had well fitted him for the work, and his old friend General Morris Schaff said truly that " Dr. Abbott came near being the most ideal public servant that this Commonwealth ever had or ever will have in her service."

An Ideal Secretary

To detail the story of Dr. Abbott's work for the State Board of Health would be to repeat much of the history elsewhere given in this volume. As Secretary and Executive Officer he maintained a grasp on the entire work of the Board. Practically all of the extensive correspondence was carried on through his office. Records were written and annual reports

prepared under his careful supervision. He had a most systematic mind and worked quickly and logically. Reliability, trustworthiness, and faithfulness were important characteristics, to which was added an unusually sound judgment. If one were to pick out any particular field in which he excelled, it would be that of vital statistics. These were his delight. He edited the *Registration Reports of Massachusetts* from 1886 to 1890, which reports have been referred to as models of style and arrangement, and the *Vital Statistics of New England*, from 1892 until his death. He was very largely responsible for the arrangement of the statistical matter in the reports of the State Board of Health. He was a member of the Royal Statistical Society of Great Britain and the American Statistical Society, and was a frequent contributor to statistical journals.

A Master of Statistics

He was also interested in medical and surgical subjects, and wrote extensively for the medical journals. One of his best known monographs was that on the " Past and Present Condition of Public Hygiene and State Medicine in the United States," which was presented at the Paris Exposition. He took a keen interest in the work of the American Medical Association and of the American Public Health Association and of various local medical organizations.

Dr. Abbott's sudden death, on October 22, 1894, brought forth many eulogies not only from his friends in Massachusetts and in the government service, but from those who had known his work through his reports. They all speak of his modesty, his faithfulness, and his conscientious devotion to duty. The State Board of Health caused to be spread upon its records these words:

Memorial to Dr. Abbott

Samuel Warren Abbott, M.D., was appointed health officer of the State Board of Health, Lunacy, and Charity on Dec. 2, 1882. Upon the re-establishment of the Board of Health in 1886 he was elected secretary and executive officer of the Board. Throughout all these

years, and until his death on Oct. 22, 1904, he was the able, devoted, and untiring officer of a service to which he gave with enthusiasm the best years of his life. His capacities in the preparation and discussion of vital statistics were everywhere acknowledged by the masters of the subject, and there was no department of public hygiene which had so great an attraction for him but he neglected none of the essentials in the administration of the laws for the protection and promotion of the public health.

He gave his early years to the perilous service of his country in time of war, and spent his later years in an equally determined struggle for safety of the lives of his fellowmen.

Dr. Abbott's life should be an example to the young men who are now training themselves for service in departments of public health.

Hiram Francis Mills[1]

The Hydraulic Engineer

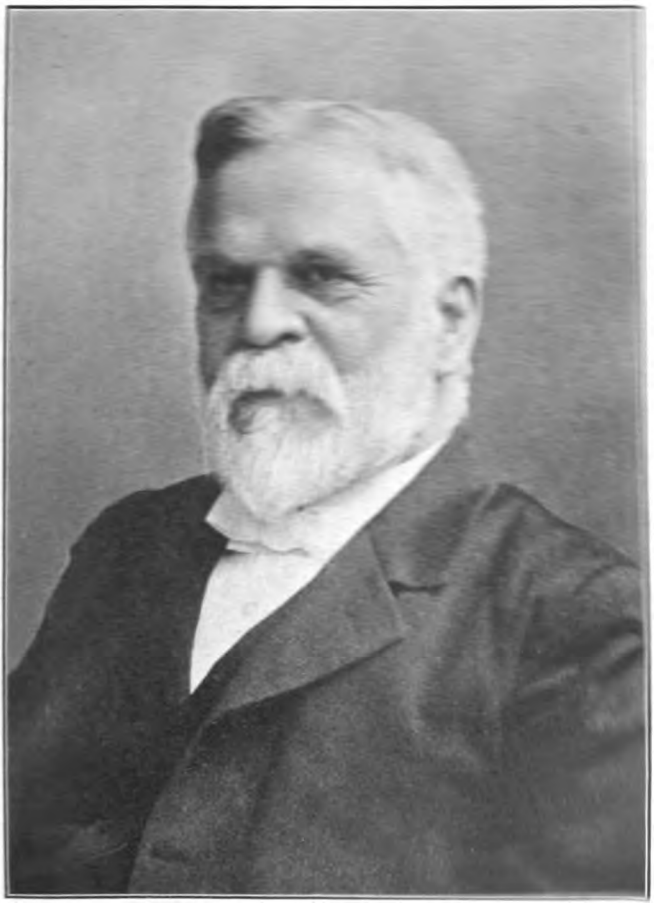
Hiram Francis Mills, hydraulic engineer and sanitary expert, and for nearly thirty years a member of the State Board of Health of Massachusetts, was born at Bangor, Maine, November 1, 1836. His father was a well-known physician of that city, and in the city schools the future engineer received his early education. He was graduated from the Rensselaer Polytechnic Institute at Troy, N. Y., in the class of 1856. His first work after graduation was as assistant engineer on the Bergen Tunnel of the Brooklyn Water Works. This was followed by work at Cohoes, N. Y., on water power measurements, the construction of mills at Lowell, work in regard to the flow of rivers and the drainage of swamps, and on the famous Hoosac Tunnel, Mr. Mills being resident engineer at the east end of the tunnel. After this he was employed on railway location in Nova Scotia and the construction of a dam across the Deerfield River in Massachusetts. He was in general practice for eleven years with a Boston office, and his reputation as an expert in hydraulic engineering became

[1] By Harry W. Clark.

Chief Engineer of the Essex Company

so well established that in 1869 he became chief engineer to the Essex Company. This company owns the dam and canal on the Merrimack River at Lawrence, controlling the water power there. This position, Mr. Mills now holds (1916), together with that of Engineer to the Locks and Canals Company of Lowell (since 1894). At Lawrence he carried on experiments in hydraulics concerning the development of methods and instruments for the measurement of water power furnished to the Lawrence mills, and brought the efficiency of the Pitot tube to a point never before reached. As an engineer in the field of hydraulics his services have been in much demand throughout the country for many years, and the results of his studies and work are found in many states. When the State Board of Health was reorganized in 1886, Mr. Mills was appointed a member, and so remained until the Board was legislated out of existence in 1914. Through all this period he gave to the state a large amount of time and study entirely without remuneration. His devotion to this work and to the interests of the state has seldom been equalled and never surpassed by any of the men who have served Massachusetts faithfully and well upon her state boards and commissions. On his appointment to the Board, he became chairman to the Committee on Water Supply and Sewerage. Under his leadership a comprehensive system of examination of the water supplies and the important rivers of the Commonwealth was organized, and the establishment of the Experiment Station at Lawrence was authorized by the Legislature for extensive investigations upon the purification of water and sewage and upon allied subjects. As chairman of this committee, all the extensive work of the Board in regard to water supplies and the advice given by the Board to cities and towns concerning water supplies, sewerage, sewage purification, and drainage came before him for his opinion and judgment. He was chairman of the committee of the Board

Chairman of Committee on Water Supply and Sewerage



HIRAM FRANCIS MILLS, C.E.

engaged in studying different plans of and the final designs for the great Metropolitan sewerage system and Metropolitan water supply of the state, serving also as consulting engineer to the Metropolitan Water Board in the construction of the Wachusett dam and reservoir. In 1892, he planned and had general oversight of construction of the sand filter which purifies the water supply of the city of Lawrence. This was the first large scientifically designed municipal filter in America. Its operation has resulted in practically eliminating water-borne typhoid fever from the city of Lawrence and has lowered the death-rate of the city very materially. Its results have not only benefited the city of Lawrence but have been the main stimulus for the construction of many filters throughout the country for the purification of water supplies.

The Lawrence Filter

The first three years' work of the famous Lawrence Experiment Station was described by Mr. Mills in two volumes issued by the State Board of Health in 1890, that dealing principally with the work of the Station being entitled, "Purification of Sewage and Water." This was the first accurate and painstaking description of modern scientific work upon these subjects and is much referred to and quoted even today.

Mr. Mills was granted the degree of Master of Arts by Harvard University in 1889; for many years he has been a Fellow of the American Academy of Arts and Sciences; a member of the Corporation of the Massachusetts Institute of Technology since 1885; and in 1909, was made an honorary member of the American Society of Civil Engineers. He married Elizabeth Worcester of Waltham, October 8, 1873.

Mr. Mills now (1916) resides at Lowell, Massachusetts, and although more than eighty years old, continues to practice his profession.

CHAPTER XIV

THE STATE DEPARTMENT OF HEALTH
(1914–1916)

THE act creating the State Department of Health was approved July 7, 1914. It provided for a Commissioner of Health, who, with a Public Health Council of seven, the Commissioner himself being one of these members, should exercise all the powers and perform all the functions of the State Board of Health. The Act read as follows:

ACTS OF 1914, CHAPTER 792.

AN ACT TO CREATE A STATE DEPARTMENT OF HEALTH AND TO AMEND THE PUBLIC HEALTH LAWS.

Be it enacted, etc., as follows:

Act establishing the State Department of Health

SECTION 1. There is hereby created a state department of health which shall exercise all the powers and perform the duties now conferred and imposed by law upon the state board of health. The state department of health shall consist of a commissioner of health and a public health council. There shall also be directors of divisions, district health officers and other employees as hereinafter provided.

Commissioner of Health

SECTION 2. The commissioner of health shall be appointed by the governor, with the advice and consent of the council, and he shall be a physician skilled in sanitary science and experienced in public health administration. The term of office of the commissioner of health shall be five years. He shall receive an annual salary of seventy-five hundred dollars and shall devote his entire time to his official duties. The commissioner of health shall be the administrative head of the state department of health. His powers and duties shall be to administer the laws relative to health and sanitation and the regulations of the department; to prepare rules and regulations for the consideration of the public health council; and, with the approval of the public health council, to appoint and remove directors of divisions, district health officers, inspectors, and other necessary employees, and to fix their

compensation, subject to the approval of the governor and council, within the limitations of appropriations therefor. Directors of divisions and district health officers shall be exempt from civil service regulations. The commissioner of health shall submit annually to the public health council a report containing recommendations in regard to health legislation; and he shall perform all executive duties now required by law of the state board of health and such other duties as are incident to his position as chief executive officer. He may direct any executive officer or employee of the state department of health to assist in the study, suppression or prevention of disease in any part of the commonwealth.

Public Health Council

SECTION 3. The public health council shall consist of the commissioner of health and six members, hereinafter called the appointive members, at least three of whom shall be physicians, and who shall be appointed by the governor, with the advice and consent of the council. Of the members first appointed, two shall hold office until the first day of May in the year nineteen hundred and fifteen, two until the first day of May in the year nineteen hundred and sixteen, and two until the first day of May in the year nineteen hundred and seventeen, and the terms of office of the said members thereafter appointed, except to fill vacancies, shall be three years. Vacancies shall be filled by appointment of the governor, with the advice and consent of the council, for the unexpired term. The public health council shall meet at least once in each month, and at such other times as they shall determine by their rules, or upon the request of any four members, or upon request of the commissioner of health. The appointive members shall receive ten dollars a day while in conference, and their necessary traveling expenses while in the performance of their official duties. It shall be the duty of the public health council to make and promulgate rules and regulations; to take evidence in appeals; to consider plans and appointments required by law; to hold hearings; to submit annually to the general court, through the governor, a report, including recommendations as to needed health legislation; and to discharge other duties required by law; but it shall have no administrative or executive functions.

Divisions

SECTION 4. There shall be in the state department of health such divisions as the commissioner of health may, with the approval of the public health council, from time to time determine. The commissioner of health shall apoint and may remove, with the approval of the public health council, a director to take charge of each division, and shall pre-

scribe the duties of such division. The compensation of directors of divisions shall be fixed by the commissioner of health, within the limits of appropriations therefor, and subject to the approval of the governor and council.

District Health Officers

SECTION 5. The commissioner of health, with the approval of the public health council shall, from time to time, divide the state into eight health districts and shall appoint and may remove a district health officer for each district, with the approval of the public health council, at a compensation, subject to the approval of the governor and council, not exceeding thirty-five hundred dollars a year. The district health officers shall not engage in any other occupation and shall give their entire time to the performance of their duties. The commissioner of health may, from time to time, order two or more of said district health officers to work in one district in order to study, suppress, or prevent disease. Each district health officer shall have all the powers and perform the duties now provided by law for inspectors of health and further shall, under the direction of the commissioner of health, perform such duties as may be prescribed by, and shall act as the representative of the commissioner of health and under his direction shall secure the enforcement within his district of the public health laws and regulations. Said district health officers shall be graduates of an incorporated medical school admitted to practice in the commonwealth, or shall have had at least five years' experience in public health duties and sanitary science.

SECTION 6. For carrying out the purposes of this act there shall be appropriated for the purposes of the state department of health, over and above the amount already appropriated for the state board of health for the year nineteen hundred and fourteen, the sum of ten thousand dollars.

SECTION 7. Present employees shall be continued in office until their successors are appointed and qualified, or until removed by the commissioner: *provided, however*, that no employee shall be removed who was appointed, or is now employed, under the provisions of the civil service laws and regulations, other than for cause, except division heads and district health officers who shall be appointed as hereinbefore provided.

SECTION 8. Sections one, two and three of chapter seventy-five of the Revised Laws and all other acts and parts of acts inconsistent herewith are hereby repealed. [*Approved July 7, 1914.*]

Although the State Board of Health went out of existence on August 6, 1914, it was several months before Governor Walsh appointed a Health Commissioner and Council. The new Commissioner took office on November 2, 1914; the members of the Council were appointed December 9, 1914. The Secretary went out of office with the Board, but the other subordinates remained. During the interim, from August 6 to November 2, the administrative work was carried on by Dr. William C. Hanson, the former Assistant to the Secretary, who was appointed by the Governor as Acting Commissioner of Health.

First Meeting of the Council

The first meeting of the new State Department of Health was held at the State House on December 12, 1914, at which time Governor Walsh administered the oath of office and made a brief address. The new officials were

Dr. ALLAN J. McLAUGHLIN.....	Commissioner of Health
Dr. ALLAN J. McLAUGHLIN.....	Member of Public Health Council
Professor WILLIAM T. SEDGWICK.	" " " " "
Professor GEORGE C. WHIPPLE ..	" " " " "
Dr. DAVID L. EDSALL.....	" " " " "
Dr. JOSEPH E. LAMOUREUX	" " " " "
Dr. WILLIAM J. GALLIVAN	" " " " "
Dr. MILTON J. ROSENAU [1]	" " " " "
Mr. JOHN T. WHEELWRIGHT [2] ...	" " " " "

The present organization (1916) is as follows:

Organization in 1916

I. The State Department of Health consists of the Commissioner of Health and the Public Health Council. Acting jointly these exercise the powers formerly vested in the State Board of Health.

II. The Public Health Council is organized into standing committees.

Sanitary Engineering (including housing and rural sanitation)

Professor Whipple (Chairman), Professor Sedgwick, Dr. McLaughlin, and Mr. Wheelwright.

[1] Resigned Jan. 27, 1915. [2] Appointed May 1, 1915, in place of Dr. Rosenau.

Organization in 1916

Preventive Medicine and Hygiene

Dr. Edsall (Chairman), Dr. Gallivan, Dr. McLaughlin, Dr. Lamoureux.

Food and Drugs

Professor Sedgwick (Chairman), Dr. Gallivan, Dr. Lamoureux, Mr. Wheelwright.

Finance, Law, and Demography

Dr. McLaughlin (Chairman), Professor Whipple, Dr. Gallivan, Mr. Wheelwright.

III. The salaried force is organized into divisions, each in charge of a director who reports to the Commissioner of Health.

Division of Administration

In charge of the Commissioner of Health.

Division of Sanitary Engineering

X. H. Goodnough, Chief Engineer and Director.

In general charge of purity of inland waters; engineering advice to cities and towns; other engineering matters.

Division of Water and Sewage Laboratories

Harry W. Clark, Chemist and Director.

In charge of Water and Sewage Laboratories at State House.

In charge of Lawrence Experiment Station.

Division of Food and Drugs

Hermann C. Lythgoe, Analyst and Director.

In charge of Food and Drug Laboratories at State House.

In general charge of food inspection.

Division of Biologic Laboratories

Dr. Milton J. Rosenau, Pathologist and Director.

In charge of Antitoxin and Vaccine Laboratory at Forest Hills.

In charge of Wassermann Laboratory at Harvard Medical School.

Organization in 1916

Division of Communicable Diseases

Dr. Eugene R. Kelly, Director.

In charge of District Health Officers.

Diagnostic Laboratory in State House.

Epidemiology, vital statistics, etc.

Division of Hygiene

Professor Selskar M. Gunn, Director.

In charge of child hygiene, infant welfare, etc.

Publication.

IV. The state is divided into eight districts, to each of which is assigned a District Health Officer.

STATE DISTRICT HEALTH OFFICERS

The Southeastern District	ADAM S. MACKNIGHT, Fall River
The Eastern District	MERRILL E. CHAMPION, M.D., Wollaston
The Northeastern District	LYMAN A. JONES, M.D., Swampscott
The North Midland District.....	CHARLES E. SIMPSON, M.D., Lowell
The South Midland District.....	WILLIAM W. WALCOTT, M.D., Natick
The Wachusett District..	LEWIS FISH, M.D., Fitchburg
The Connecticut Valley District.....	JOHN S. HITCHCOCK, M.D., Northampton
The Berkshire District...	STANLEY H. OSBORN, M.D., North Adams

The history of the new State Department of Health remains to be written. At this time all that it is fitting for the author to say is that its work has been well begun, with enthusiasm among its members and with the goodwill of the local boards of health. It is to be hoped that its record will be as good as, and even surpass, if possible, that of the State Board of Health which it replaced; that its work will be not only a continuation but an expansion of that which has so greatly benefited the people and given fame to the Commonwealth throughout the world. In order to achieve this result it will be necessary to follow in the future the watchwords which have been so steadily adhered to in the past, namely: —

SANITARY SCIENCE COUPLED WITH WISE STATESMANSHIP; PREDOMINATION OF ADVISORY FUNCTIONS OVER REGULATIVE FUNCTIONS; CO-OPERATION WITH LOCAL HEALTH AUTHORITIES; EDUCATION IN PUBLIC HEALTH; AND, ABOVE ALL, A RECOGNITION OF THE PRINCIPLE THAT PUBLIC HEALTH IS CONCERNED NOT ALONE WITH DISEASE, BUT WITH ALL OF THE ENVIRONMENTAL CONDITIONS WHICH MAKE FOR WHOLESOME, DECENT AND COMFORTABLE LIVING.

CHAPTER XV

STATE SANITATION

IT had been the intention of the author to devote this final chapter to a general discussion of the principles of state sanitation, using the Massachusetts State Board of Health as an example — nay as a model — and showing how the example of Massachusetts has been followed, with variations, by the other states; but the recent publication of Dr. Chapin's comprehensive report on "State Public Health Work," [1] based on an actual survey of all of the state boards of health in the country, would make such a discussion a work of supererogation. Yet for the benefit of students of sanitation, present practice will be discussed briefly, making frequent use of Dr. Chapin's studies, and cordially recognizing his courtesy in permitting quotations of more than ordinary length.

State Health Organizations

At the present time [2] every state in the union has a central public health organization. This is usually called the State Board of Health, but in a few instances, the State Department of Health. Where the organization is that of a board, the secretary of the board generally acts as the executive Health Officer. In some states, however, this executive is called the Commissioner of Health, the Director of Health, the State Health Officer, or the Superintendent of Health. Oklahoma has no board provided for by law, but the Commissioner of Health has formed an advisory board to aid him.

The qualifications of the members of these state boards of health vary all the way from "physicians learned in sanitary science" to "discreet citizens." In some states the gover-

[1] A report on "State Public Health Work," by Dr. Charles V. Chapin, made under the direction of the Council on Health and Public Instruction of the American Medical Association. Published by the American Medical Association. 1916.

[2] 1916.

nor, the attorney-general, or other state officers are ex-officio members of the state board of health; in some states the medical associations are recognized; and in one state, Alabama, the members of the board must be " Censors of the State Medical Association." The members of the state boards of health are usually appointed by the governor, and subject to confirmation by the senate or council.

Qualifications of Members

In 1850, Lemuel Shattuck advised a mixed membership for a state board of health, consisting of " two physicians, one councillor-at-law, one chemist or natural philosopher, one civil engineer, and two persons of other professions or occupations — all properly qualified for their office by their talents, their education, their experience, and their wisdom." In general, Massachusetts has followed this idea with eminent success. Dr. Chapin believes that with a competent executive it is better that the members of the board should not be professional sanitarians in active practice, but physicians and laymen of ripe judgment. The main thing in the author's opinion is to obtain men of intellectual breadth, wisdom and character, men whom people and legislators will trust, men who will take a lively interest in their work. If at the same time they have some technical knowledge of health matters, so much the better. Dr. Chapin is quite right, however, that no professional sanitarian should serve as a member of a state board of health and at the same time practice within the limits of the state. Sooner or later public and private interests are sure to conflict; this does not refer, of course, to physicians of regular practice. In fourteen states the laws require that all of the members of the state boards of health shall be physicians: in fourteen other states a majority of the members must be physicians; and in six, one or more members must be physicians.

The usual number of members of a state board of health is seven, as suggested by Lemuel Shattuck, but this varies in

different states from three to thirteen. Continuity is secured by making appointments for long terms, and by arranging to have only a minority of the members go out of office at one time.

Politics

It is of the highest importance that state boards of health should be as far as possible removed from politics. In order to make the positions on these boards unattractive to political office holders, it is generally considered wisest to have the members of the board unpaid, or at most receive a merely nominal compensation for attendance at meetings; for the same reason it is best to limit the powers of the boards chiefly to advisory functions.

The Health Commissioner

A strong executive officer is absolutely essential. This officer, whether called the Secretary of the Board, or the Health Commissioner, should be a man of the highest technical ability. No one should be elected to this important position unless he has had training in sanitation and experience in public health work. He must be a good administrator, a man of discernment in choosing assistants, and of judgment in selecting the most efficient means for the promotion of the public health. "It is worse to waste the state's money in fruitless lines of endeavor than it is to dissipate it by poor administration." Preferably the Health Commissioner should be chosen by the Board and responsible to it. In some states he is appointed by the Governor.

In order to secure the best results the chief health executive should give all of his time to the work, should be chosen for a long term, say four to six years, and should receive a sufficient salary. At present the salaries of executive officers vary from $200 to $10,000 per year. It is usually difficult to secure a man of the right sort for a salary of less than $5,000 per annum. Freedom of choice in the selection of a health officer should be provided for. "A most ridiculous, antiquated and mischievous provision is found in the statutes,

and even the constitutions, of some states, that the incumbent of this office must be a resident of the state and even a voter, for it frequently happens that the most suitable person for a position like this cannot be found within the confines of the state." It might be added that this criticism applies to the choice of municipal health officers as well as to state health executives.

Judicial Powers

While, in general, it may be said that the most useful work done by a state department of health is accomplished in an advisory way, yet there are certain governmental powers which should properly be conferred upon this department. These powers cover the three principal divisions of civil governmnent with which Americans are familiar, namely, the judicial, the legislative, and the executive. Dr. Chapin describes these as follows:

> It is often necessary for the health department to act in a sort of judicial capacity. In the case of certain nuisances, especially offensive trades, the state board of health may be authorized, or directed, to hold hearings and to listen to the evidence presented by opposing parties and to render a decision. Similar action may have to be taken in regard to the pollution of streams, to food adulteration, or to violations of medical practice acts. In some states these hearings are specially provided for by law.

Legislative Powers of State Health Departments

Most state boards of health are given certain legislative powers. Sometimes this power is very broad; sometimes it is quite restricted. A very broad grant, such as to make " rules for the protection of the public health " is virtually conferring on the board of health great legislative power, and a power which may profoundly affect the lives and property of the citizens. It is sometimes a difficult matter to decide the extent to which a legislature may lawfully delegate such power to a state board of health. While there has been a disposition in some states to question the constitutionality of these broad powers, there seems to be no objection anywhere to the making of rules for the purpose of defining and carry-

ing out the details of measures authorized by the Legislature. Thus it is probably always permissible to authorize a state department of health to declare what diseases are to be considered communicable, and how they shall be reported; to determine the manner and period of isolation; to prescribe exactly what methods of disinfection shall be employed; to make rules to prevent water supplies from receiving pollution; to make regulations for the cleanliness of hotels, bakeries, and slaughter houses; to fix chemical and bacterial standards for milk and other foods; and to prescribe a great number of similar details of public health administration which need to be flexible enough to be easily changed, and which the Legislature cannot conveniently or properly consider. The increasing importance of technical details in connection with public health matters is an added reason why they cannot be competently passed upon by members of the Legislature. Among the subjects for which state departments of health commonly legislate are the regulation of communicable diseases, quarantine, control of water supplies, ice supplies, sewage disposal, garbage disposal, nuisances, public buildings, bathing places, cold storage of food, vital statistics, transportation and disposal of dead bodies, and the like. In some states the boards of health are authorized to make rules regarding the adulteration of food, and the general conservation of the waters of the state.

Health Codes

In connection with this subject the question of public health codes must necessarily be considered. While it is a convenience to have such codes for states, it seems to be a fact that up to the present time many of the so-called codes have not been well drawn. Massachusetts has no regular public health code, but the "Manual of Public Health Laws" practically serves the purpose of a code. The best example of a sanitary code is that recently adopted by the state of New York.

Executive vs. Advisory Functions

The extent to which executive control should be possessed by state boards of health is also a matter upon which opinion differs. Many officials believe it to be wrong in principle, and favor giving greater powers to local officials. In some states, however, the local health authorities are so inefficient that state control is practically the only way to obtain satisfactory results. The increase in foreign population has made executive control more needed than in former days. One of the problems of the future is to secure a better co-ordination of the powers of the state officials with those of local health officers.

The practice of giving broad executive powers to the state boards of health does not seem to have accomplished better results than those obtained in Massachusetts under its advisory powers, and gradually sanitarians are coming to believe that, in general, better results may be secured by educational means, and by the aid of advisory powers, than by coercion. When the cities and towns of a state come to realize that the state board of health exists primarily to assist them in the solution of their problems, and not to compel them to undertake sanitary reforms which they do not desire, and which they perhaps cannot afford, the work of the state department will increase in dignity and in power. On the other hand, it should be recognized that the power to advise must be supported by the power to enforce action, in case the public health of the state urgently demands it.

Relation between State and Local Boards

There are various ways in which state health departments have attempted to exercise control over local affairs. In some states provision is made by statute for the supervision, or direction, of local boards of health or health officers, though as a rule these powers have not been very definitely stated. Sometimes provision has been made for the state department of health to temporarily take charge of local public

health work, if sanitary affairs are not being properly cared for, and when this is done, the arrangement is that the expense incurred shall be a charge upon the local community. Another way is that of prescribing the necessary qualifications for local health officials. Thus, in New York state the law requires that the state health council shall have the power to prescribe the qualifications of local health officers. A step further in this direction would place the appointment and removal of local health officers in the hands of central authorities. In Vermont the township health officers are appointed by the State Board of Health.

A slightly different method of co-operative work is that which has long been used in Europe, and which in the United States was first used in Massachusetts, namely, the appointment by the State Board of Health of health inspectors, or district health officers, whose function it is to assist in the co-operation of local authorities, and to act as a means for the State Board of Health to assist the local boards. Mention is made of the work of these district health officers elsewhere in this volume. In New York state the law which went into effect in January, 1914, provided for a division of the state into sanitary districts, each with a Supervisor appointed by the Commissioner of Health. New York city was excepted on account of the special conditions which exist there. The duties of the Supervisor are specified in the act as follows:

Sanitary Districts

1. To keep himself informed as to the work of each local health officer within his sanitary district.

2. To aid each local health officer within his sanitary district in the performance of his duties, and particularly on the appearance of any contagious disease.

3. To assist each local health officer within his sanitary district in making an annual sanitary survey of the territory within his jurisdiction, and in maintaining therein a continuous sanitary supervision.

4. To call together the local health officers within his district or any portion of it from time to time for conference.

5. To adjust questions of jurisdiction arising between local health officers within his district.

6. To study the causes of excessive mortality from any disease in any portion of his district.

7. To promote efficient registration of births and deaths.

8. To inspect from time to time all labor camps within his district and enforce the regulations of the public health council in relation thereto.

9. To inspect from time to time all Indian reservations and enforce all provisions of the sanitary code relating thereto.

10. To endeavor to enlist the co-operation of all the organizations of physicians within his district in the improvement of the public health therein.

11. To promote the information of the general public in all matters pertaining to the public health.

12. To act as the representative of the state commissioner of health and under his direction, in securing the enforcement within his district of the provisions of the public health law and the sanitary code.

North Carolina's "Unit Plan"

In North Carolina the state department of health put into effect what is called the "unit plan" for the state direction of local health work. According to it the unit refers to the kind of health work which the state proposes to undertake, and not to a geographical area. The advantage claimed for this plan is that where the rural districts cannot afford to maintain a full time health officer and carry on all of the important kinds of public health work, they may be induced to take them up, one at a time, paying the state health department to do the particular task selected. The plan enables specially trained men employed by the state gradually to extend their activities over the entire area. An example of this work is the contract which was entered into with ten counties in North Carolina, in 1915, for free immunization against typhoid fever. Each county appropriated five hundred dollars, and in some counties as many as one third of the people were immunized. In Florida practically all of the local work is done by the state, and in Pennsylvania this is true for about one quarter of the population in the rural districts.

Another useful way of co-ordinating and improving local public health work is that of holding regular conferences of local health officers at which matters of public health are discussed. In some states such meetings have been held for more than a generation, and have virtually been schools for health officers. Sometimes these associations are voluntary, but in other instances, the local officials are required to attend the conferences. On account of the expense connected with these conferences — an expense which often has to be borne by the individuals attending — the idea has been suggested in some states of arranging for correspondence courses covering various questions of hygiene and sanitation. All of these matters are ably discussed by Dr. Chapin in his report.

Conferences of Health Officers

Dr. Chapin says:

Public Health Education

One of the most important functions of a state health department is to instruct the people in the science and art of sanitation. They must be taught how disease is caused and how it can be prevented. Among the methods now commonly used may be mentioned monthly bulletins used by the state departments of health, special bulletins, posters, special articles written for the local press, public lectures and exhibits, public health cars to carry these exhibits around the state, and intensive campaigns of all sorts such as "Clean Up Weeks," "Health Days," and the like. At the present time there appears to be no danger that public health education is being neglected. On the contrary there is some danger lest the work be overdone. Sanitation and public health have been taken up by the press as features and they are often used for advertising purposes. Newspapers, magazines, the platform, and the pulpit have been invaded by public health propaganda. There is no fear for lack of quantity, but there is great danger that the quality may suffer. The most important thing in public health education is to tell the truth. If sanitary science were an exact science, false teaching would be easily found out. Because it is not an exact science it requires care in teaching. It should not be made still more inexact by lapses from the truth. It is not necessary to be false to be interesting, though it is much easier. It takes some trouble to find out the truth. It is easier to guess at it. The hurried writer often does. There are enough things that are certain. There is no need of teaching what is

uncertain. The great fault in health education today is that it does not always teach the absolute truth. In studying the efficiency of health education one should bear in mind especially its simplicity, attractiveness, truth, and ability to reach the people.

Publications

This subject of public health education raises a question of policy, which ought to be discussed seriously. Should a state board of health attempt to teach the individuals of a state directly, or ought it to instruct the teachers, to furnish the data, to formulate the principles of hygiene and sanitation, leaving it for those who are in close touch with individuals to make the practical applications? While differences among the states may make both methods necessary the author is strongly of the opinion that the latter method is the one which in the end will yield the best results. The endeavor of a state department of health to write its bulletins for the ignorant reader, and to issue cartoons which border on the witty, the flippant, or the horrible, is bound to lower the tone of public health writings generally, to greatly increase the cost of health departments, and to lessen the respect for their authority. It would be far better for the state departments of health to keep all of their publications on a high plane, maintaining what may be called a university standard.

Quarantine

Our state form of government restricts the public health measures which can be carried out by the federal government; yet there are certain activities which inherently relate to the nation rather than to the states. One of these is quarantine, or the protection of the people against infection from other countries. To a great extent quarantine powers are now exercised by the United States Public Health Service, a division of the Treasury Department, but until recently the City of Boston had charge of the quarantine station of that city, and the State of New York had charge of the quarantine station of New York. This service ought to be national.

States now have the power to apply quarantine regulations against other states. During epidemics of yellow fever, these powers were sometimes exercised. Even now quarantine regulations affecting animals are not uncommon. The great development of transportation facilities has largely wiped out state boundaries, however, and quarantine regulations based on such lines are becoming more and more illogical. Internal quarantine ought also to be under national control, just as much as the regulation of interstate commerce. We have recently seen the need of this in the attempts made to prevent the spread of infantile paralysis.

The inspection of immigrants is another national public health function already exercised by the Public Health Service.

Pollution of Interstate Streams

There are many questions relating to the pollution of streams which involve interstate relations. The United States Supreme Court is now the only tribunal before which conflicting interests can be brought. A famous case was that of the State of Missouri acting in the interest of the City of St. Louis against the State of Illinois and the Chicago Sanitary District, in which it was claimed that the sewage of Chicago, sent westward through the Drainage Canal, contaminated the water supply of St. Louis. There are those who believe that this whole matter of interstate stream pollution should be placed under the control of a national authority. Others believe that advisory powers by an impartial national authority would be sufficiently effective, and would be better suited to our form of government — the Supreme Court always being available in case of the failure of the gentler methods.

No one can doubt the desirability of co-operation between states, and the establishment of uniform standards of various kinds. The United States Public Health Service is doing excellent service in fostering such co-operation, by means of its

annual conferences, by its scientific investigations, and its publications.

There are various other departments of the federal government which have to do with public health matters. In the Department of Agriculture the Bureau of Chemistry has charge of the enforcement of the Federal Pure Food Law, and the Bureau of Animal Diseases has charge of certain dairy matters and meat inspection. In the Department of Labor there is a Children's Bureau, while Vital Statistics are kept by a division of the Bureau of the Census in the Department of Commerce.

A Federal Department of Health

There are good reasons for the assembling of some of these activities in a National Department of Health, and some time this will probably be done. On the other hand there are objections to the multiplication of cabinet positions. Meantime the Public Health Service is growing in power and efficiency, and is more and more coming to perform the functions of a Federal Department of Health.

Cost of State Departments of Health

It is difficult to compare the cost of the state boards of health in the different states because of the great differences in the kind of work attempted and the conditions under which it is done. It is interesting, however, to compare the total expenditures of the different states for public health purposes. These are given by Dr. Chapin as follows:

ANNUAL EXPENDITURES OF STATE DEPARTMENTS OF HEATLH *

Expenditure for Health		Cents Per Capita	
Pennsylvania	$1,047,431.66 [1]	Florida	15.21
New York	284,676.85	Pennsylvania	12.70
Massachusetts	180,219.14	Maryland	10.54
Maryland	142,600.00	Vermont	9.27
Illinois	133,919.60	Nevada	7.59
Florida	129,012.03	Montana	5.45
New Jersey	125,942.15	Idaho	5.22
California	112,953.48	Massachusetts	4.95
Ohio	91,736.25	Louisiana	4.93

[1] Also $1,183,542.07 for tuberculosis sanatoria.

* "State Public Health Work" by Dr. Charles V. Chapin, 1916, p. 192.

ANNUAL EXPENDITURES OF STATE DEPARTMENTS OF HEALTH (cont'd)

	Expenditure for Health		Cents Per Capita
Louisiana	$87,491.20	New Hampshire	4.81
Minnesota	72,013.31	New Jersey	4.47
Indiana	64,719.00	Delaware	4.04
North Carolina	61,031.78 [1]	California	3.96
Texas	48,200.00	Arizona	3.76
Kansas	46,430.00	Minnesota	3.25
Virginia	45,000.00 [2]	Rhode Island	3.14
Michigan	44,872.07	Utah	2.60
Wisconsin	38,205.63	Kansas	2.60
South Carolina	36,112.52 [3]	New York	2.87
Vermont	33,385.50	North Carolina	2.60
Georgia	33,311.90	Indiana	2.32
Oklahoma	32,700.00	South Carolina	2.27
Iowa	32,568.32	Connecticut	2.24
Kentucky	30,002.45	Colorado	2.19
Missouri	29,206.19	Virginia	2.09
Connecticut	27,000.00	Maine	1.95
Alabama	25,000.00	Ohio	1.80
Montana	23,600.00	Illinois	1.78
Mississippi	22,975.43	Oregon	1.78
New Hampshire	21,200.00	Oklahoma	1.61
Idaho	19,820.00	Wisconsin	1.56
Colorado	19,980.00	North Dakota	1.48
Rhode Island	18,569.18	Michigan	1.48
Tennessee	16,552.49	Iowa	1.46
Washington	15,240.00	South Dakota	1.43
Maine	14,893.24	Kentucky	1.27
Oregon	14,000.00	Wyoming	1.24
West Virginia	14,000.00	Georgia	1.21
Utah	12,150.00	Texas	1.13
Nebraska	10,640.00	Alabama	1.11
North Dakota	10,569.38	Washington	1.08
South Dakota	9,730.00	Mississippi	1.20
Arizona	9,300.00	West Virginia	1.02
Arkansas	8,970.00	Missouri	.86
Delaware	8,492.02	Nebraska	.85
Nevada	7,500.00	Tennessee	.73
Wyoming	2,100.00	Arkansas	.53

[1] Also $52,376.79 for tuberculosis sanatoria.
[2] Also $45,000 for tuberculosis sanatoria.
[3] Also $10,000 for tuberculosis camp.

Dr. Chapin endeavored to compare the public health work in the different states by giving to each a rating based upon the volume and character of the activities. A score card was used for this purpose and a value assigned to each activ-

Efficiency Score Card for Mass. State Board of Health

ity, these values adding up to a total of 1,000, which was supposed to represent a perfect score. The following tables, taken from Dr. Chapin's report show how this perfect score was made up, and how the work of the Massachusetts State Board of Health was the nearest approach to this perfect standard.

RATING OF MASSACHUSETTS STATE BOARD OF HEALTH
(According to Dr. Chapin)

	Perfect Score	Mass. State Board of Health
Supervision of Local Health Officers:		
Personal supervision	60	60
Conferences	20	0
Bulletins	20	15
Communicable Diseases:		
Notification	30	26
Direct control	80	70
Intensive work	50	0
Tuberculosis:		
Notification	20	20
Sanatoria	20	20
Hospitals	20	20
Dispensaries	20	20
General education	30	0
Intensive work or direct control	30	10
Diagnostic Laboratory:		
Scope of work	10	4
Amount of work	70	70
Distribution of Sera and Vaccines:		
Varieties	10	10
Amount	40	40
Vital Statistics:		
Deaths	40	40
Births	40	40
Tables	20	20
Child Hygiene:		
Intensive work	40	0
Literature to mothers	10	0
Prevention of ophthalmia	10	10
Supervision of midwives	10	0
Education:		
Newspapers	30	0
Bulletins	30	15
Exhibits	30	10
Lectures	10	10
Carried forward	800	530

RATING OF MASSACHUSETTS STATE BOARD OF HEALTH (cont'd)

	Perfect Score	Mass. State Board of Health
Brought forward	800	530
Food:		
Milk supervision	40	35
Sanitary handling of food	20	12
General sanitation:		
School construction	20	10
Public institutions	10	8
Hotels and camps	10	0
Control of Water and Sewage:		
Approval of plans	40	40
Surveys	30	30
Supervision	30	30
Extra Credits	0	50
	1000	745

RATING OF STATE BOARDS OF HEALTH

(According to Dr. Chapin)

Comparative Efficiency Ratings

	Perfect rating 1000		Perfect rating 1000
Massachusetts	745	Florida	262
New York	730	Montana	253
Pennsylvania	716	Oregon	227
Minnesota	574	Iowa	225
New Jersey	555	South Carolina	165
Indiana	526	Utah	161
Maryland	507	Georgia	156
Kansas	499	Missouri	152
North Carolina	411	North Dakota	139
Virginia	397	Delaware	131
Rhode Island	432	Idaho	127
North Carolina	432	Tennessee	122
Virginia	397	Texas	116
Connecticut	393	West Virginia	113
Kentucky	393	Colorado	106
Wisconsin	392	Alabama	101
Michigan	370	South Dakota	105
Illinois	346	Oklahoma	97
California	342	Nevada	94
New Hampshire	320	Arkansas	74
Louisiana	325	Nebraska	66
Mississippi	297	Arizona	39
Maine	280	Wyoming	10
Washington	262	New Mexico	0

The Public Health Pendulum

Prevailing ideas in regard to public health have their periodic movements; each new discovery eclipses for a time all the ideas which have become established. These pulsations are often due to the motive power of great basic ideas or passions inherent in the human race, or to the recurrence of certain fundamental conceptions. The pendulum swings from the spiritual to the material, from the conservative to the radical, from the aristocratic to the democratic, from peace to war, and then it swings back again from war to peace, from radical to conservative, from the material to the spiritual — so it has ever been. In these changes the new ideas cause us temporarily to forget the good which lay in the old. We have seen these changes take place in the biological world, and within rather a short time, the emphasis has been shifted back and forth between heredity and environment.

In the days of Lemuel Shattuck, it was man's environment which was thought to have most to do with his health. The early investigations of the Massachusetts State Board of Health were concerned with the air he breathed, the water he drank, the food he ate, the houses he lived in, the disposal of his waste products, but since the days of Pasteur bacteriology has ruled the health officer, the "new public health" has taken its place. Emphasis has been placed " not upon man's environment but upon man himself." Health workers have fought communicable diseases of all kinds with new weapons, bravely, and successfully, and health departments have been organized and reorganized to that end. Dr. Chapin recognizes this point of view, and his rating schedule is founded upon the idea that the chief object of a health department is to prevent disease. Some sanitarians regard this as too narrow a view.

The New Public Health

The " new public health " movement is now in full swing, and its momentum ought some day to carry it to the point where communicable diseases have been practically obliter-

ated from the earth. Nothing in all history has done so much to reduce the suffering and misery of mankind as the curative and preventive arts which have grown out of the science of bacteriology. Never in history have the mortality and morbidity rates of the people fallen so low as since the day of Pasteur, Lister, and Koch.

Changing Conditions

Yet while these inspiring events have been claiming the attention of scientists and health officers, the environmental conditions of man have been undergoing a series of changes far-reaching in importance. While the dangers of contact infection were being demonstrated, the opportunities for contact were being increased through the growth of cities, the crowding of buildings, the multiplication of schools and factories. Within a generation we have seen a great increase in urban life, a substitution of indoor for outdoor occupations; tenement houses and "three deckers" have taken the place of single dwellings; the tall office building has appeared, and human beings have taken to a "cellular" type of housing; machines have replaced physical labor; leisure has increased; cheap transportation has replaced walking; nerves have been made to do the work of muscles — even foods have changed.

The new Public Health Methods not alone sufficient

These new conditions give rise to new health problems. While there are fewer deaths from communicable diseases, there are more deaths than formerly from constitutional diseases. The physique of the people has not improved as much as the death-rates have been lowered. In many ways we are coming to believe that the new public health methods are not alone sufficient to safeguard the public health. Although in some ways they far surpass Lemuel Shattuck's ideal, in other ways they do not reach it. It is not enough to do away with communicable disease; it is not enough to merely lengthen life.

Health is something more than the absence of disease — it has a positive quality which must be recognized. Health

should not be measured qualitatively alone, but quantitatively. It is the same in physical as in spiritual things, we should strive not only " that we may have life but that we may have it more abundantly." To this end bacteriology and sanitation must be supplemented by physiology and hygiene. Preventive measures must be applied not only to ward off disease, but to keep human bodies sound as well as clean. The Romans taught us the arts of sanitation; Pasteur showed us why cleanliness is necessary; the Greeks emphasized the idea of bodily health, — a sound mind in a sound body. We must follow the " Hygiea " of the Greeks as well as the "Sanitas" of the Romans if we are to give full meaning to the old Anglo-Saxon word " Haelth."

The Health and Comfort of the People

The old expression " the health and comfort of the people " had much to commend it. The courts recognized it. The new public health is inclined to regard comfort as a thing apart, and to consider the care of the environment, unless it bears on disease prevention, to belong in some other department of government than the board of health. The author believes this tendency to be an unfortunate one. Human health and comfort are inseparable. Cheerfulness and happiness are not only a result but a cause of good health.

The old school of public health practiced general sanitation, with the object of controlling communicable diseases *en masse*, and of promoting human vitality. The new school of public health adopts specific measures for the control of specific diseases, but to be complete, it must also see to the maintenance of a suitable environment, in order that man may live a wholesome, decent, and happy life, as free as possible from disease.

State Sanitation must be broad

State sanitation should be given a broad scope, and state departments of health should concern themselves with many things outside the range of communicable diseases; they should take cognizance of the people's health both in the new

way and the old. While emphasizing chiefly preventive measures based on bacteriology, for the reason that at the present time money spent for them will bring larger returns in disease prevention than in other ways, it should not be forgotten that the care of lakes and streams and harbors, the drainage of swamps, the disposal of garbage and rubbish and sewage, the cleaning of streets, the control of animals and insects, the elimination of foul odors, the regulation of housing, the control of offensive trades, the inspection of factories and schools, and many other environmental studies are by no means to be neglected or to be regarded as outside the legitimate functions of the state health authorities.

It is because he believes in this broad view of state sanitation that the author takes pleasure in bringing again to the attention of the public the comprehensive ideals of a former generation set forth by Lemuel Shattuck, and the varied achievements of the Massachusetts State Board of Health.

PART II

REPORT OF THE MASSACHUSETTS SANITARY COMMISSION

LEMUEL SHATTUCK
NATHANIEL P. BANKS, Jr.
JEHIEL ABBOTT

1850

CHAPTER XVI

INTRODUCTION

COMMONWEALTH OF MASSACHUSETTS

In the year One Thousand Eight Hundred and Forty-Nine

RESOLVE

Relating to a Sanitary Survey of the State

Resolved, That His Excellency the Governor, by and with the advice and consent of the Council, be and he is hereby authorized to appoint three persons to be Commissioners, to prepare and report, to the next General Court, a plan for a Sanitary Survey of the State, embracing a statement of such facts and suggestions as they may think proper to illustrate the subject. The Commissioners shall be paid, for the time actually spent in the discharge of their duty, and for their necessary travel, the same compensation that is paid to the members of the General Court; and also for blanks and circulars used, and for postage and other necessary expenses paid, in said commission; and a sum not exceeding fifty dollars, to purchase books on the subject; *provided, however*, that said books shall be considered the property of the Commonwealth, and shall be deposited in the State Library when the commission shall be dissolved: *provided*, the whole expense of said commission shall not exceed five hundred dollars; and that warrants be drawn accordingly.

HOUSE OF REPRESENTATIVES, May 1, 1849.

Passed. FRANCIS B. CROWNINSHIELD, *Speaker*.

IN SENATE, May 2, 1849.

Passed. JOSEPH BELL, *President*.

May 2, 1849. — Approved.

GEO. N. BRIGGS.

COMMONWEALTH OF MASSACHUSETTS

To all Persons to whom these Presents shall come,

GREETING:

[SEAL]

GEO. N. BRIGGS

WHEREAS, by a Resolve of our Legislature, approved by our Governor, the second day of May, in the year of our Lord one thousand eight hundred and forty-nine, entitled "Resolve relating to a Sanitary Survey of the State," it is provided, "that His Excellency the Governor, by and with the advice and consent of the Council, be and he is hereby authorized to appoint three persons to be Commissioners, to prepare and report, to the next General Court, a plan for a Sanitary Survey of the State, embracing a statement of such facts and suggestions as they may think proper to illustrate the subject":

NOW, THEREFORE, be it known, that we, by our Governor, with the advice and consent of the Council, confiding in the ability of LEMUEL SHATTUCK, of Boston, NATHANIEL P. BANKS, Jr., of Waltham, and JEHIEL ABBOTT, of Westfield, do hereby appoint them Commissioners for the purposes aforesaid, and enjoined in the Resolve above recited, with all the powers and authority, and subject to the duties and obligations which are or may be by law imposed upon them in their said capacity.

In testimony whereof, we have caused the seal of the Commonwealth to be hereunto affixed, the third day of July, in the year of our Lord one thousand eight hundred and forty-nine, and of the Independence of the United States the seventy-third.

By His Excellency the Governor, with the advice and consent of the Council.

WM. TUFTS,
Deputy Secretary of the Commonwealth.

Report of the Commissioners

The Commissioners, appointed on the third day of July last "to prepare and report, to the next General Court, a plan for a Sanitary Survey of the State, embracing a statement of such facts and suggestions as they may think proper to illustrate the subject," have considered the matters referred to them, as far as the limited time at their command, and other circumstances, since their appointment, would permit, and submit their Report.

As the object of our commission is comparatively new, and may not be clearly understood by every person, we will state what we understand to be its intention. By a Sanitary Survey of the State is meant, an examination or survey of the different parts of the Commonwealth, — its counties, its towns, and its localities, — to ascertain the causes which favorably or unfavorably affect the health of its inhabitants. The word sanitary means relating to health.[1] When we speak of the sanitary condition of a town, we include a description of those circumstances which relate to, or have an effect upon, the health of its inhabitants. When applied to the inhabitants of a town or district, in their social capacity, it relates to public health; when to individuals, it relates to personal or private health.

The condition of perfect public health requires such laws and regulations as will secure to man associated in society the same sanitary enjoyments that he would have as an isolated individual; and as will protect him from injury from any influences connected with his locality, his dwelling-house, his occupation, or those of

[1] This word is derived from the Latin sanitas, meaning "soundness of body, health." It is sometimes written, erroneously, as we think, sanatory, sanotary, and sanitory. The most correct authors, however, now write, sanitary. Hygiene (from a Greek word, derived from Hygeia, the goddess of health, meaning to be well) is defined "health, the preservation of health, that part of medicine which regards the preservation of health." Hygiean and hygienic have the same meaning as sanitary. These words are sometimes used as technical terms, especially by medical men; but we dislike, and see no good reason for substituting them for the more simple, proper, and comprehensive English words, health and sanitary, which are generally understood. We would divest our subject of all mystery and professional technicalities; and as it concerns everybody, we would adapt it to universal comprehension, and universal application.

his associates or neighbors, or from any other social causes. It is under the control of public authority, and public administration; and life and health may be saved or lost, and they are actually saved or lost, as this authority is wisely or unwisely exercised.

The condition of perfect personal health requires the perfect formation of all the organs of the body, and the perfect performance of each of their functions, in harmony with all the others. Such a condition gives to its possessor, strength, energy, power, buoyancy of spirit, happiness. Disease may be an imperfection in some organ, or a derangement or improper action in some function, or both: and it may exist, and does actually exist, in all communities, in an infinite number of degrees, from the slightest deviation from a standard of perfect health, through all the varieties of sickness, to the lowest standard of vitality, just as the body is about to perform its last respiration. Such a condition gives to its possessor, weakness, lassitude, inability, depression, pain, misery, death. And one or the other of these conditions may be chosen, and is actually chosen, to a greater or less extent, by almost every human being.

We believe that the conditions of perfect health, either public or personal, are seldom or never attained, though attainable; that the average length of human life may be very much extended, and its physical power greatly augmented; that in every year, within this Commonwealth, thousands of lives are lost which might have been saved; that tens of thousands of cases of sickness occur, which might have been prevented; that a vast amount of unnecessarily impaired health, and physical debility, exists among those not actually confined by sickness; that these preventable evils require an enormous expenditure and loss of money, and impose upon the people unnumbered and immeasurable calamities, pecuniary, social, physical, mental, and moral, which might be avoided; that means exist, within our reach, for their mitigation or removal; and that measures for prevention will effect infinitely more, than remedies for the cure of disease.

Some of the reasons for this belief will be given in the pages of this report. If it shall appear that it is well founded, — if, indeed, there are facts to support, and legitimate arguments to

sustain it, — what subject, it may be asked, can come up for consideration, that shall transcend it in importance? We look upon things as valuable, that are worthless without life, and that cannot be enjoyed without health. How much more valuable, then, the means to possess and to enjoy both life and health, which alone give value to other objects! When compared together, all other matters this side the grave dwindle into insignificance.

But whom does this great matter of public health concern? By whom is this subject to be surveyed, analyzed, and practically applied? And who are to be benefited by this application? Some will answer, the physician, certainly. True, but only in a degree; not mainly. It will assist him to learn the causes of disease; but it will be infinitely more valuable to the whole people, to teach them how to prevent disease, and to live without being sick. This is a blessing which cannot be measured by money value. The people are principally concerned, and on them must depend, in part at least, the introduction and progress of sanitary measures.

An eminent physician has recently said: "Our education has made our calling exclusively a curative, and not a conservative one, and the business of our responsible lives has confined it to us. Our thoughts are devoted to, our interests are concerned in, and our employments are connected solely with, sickness, debility, or injury, — with diminution of life in some of its forms. But with health, with fullness of unalloyed, unimpaired life, we, professionally, have nothing to do."[1] Though this may generally be true, professionally, yet the intelligent physician "can see arrows of disease, invisible to any one else; watch their havoc, and know whence they come, and how they may be stayed"; and there are many eminent medical men, who have, as individuals, nobly used the means which their superior position and knowledge have placed within their control, in the prevention of disease, and in the promotion of public health. And we wish to increase the number of such professional men. We would not, however, confine it to them. We would not make it the object of any one profession ex-

[1] Dr. Edward Jarvis, Communications, Mass. Medical Society, Vol. VIII, p. 1.

clusively.[1] We would bespeak the attention of intelligent men of all classes and all professions, whatever their prejudices or opinions may have been, to a candid consideration of the whole subject; and if found worthy, would solicit their co-operation and assistance, in its practical application and its onward progress.

"Ignorant men," says Dr. Simon, "may sneer at the pretensions of sanitary science; weak and timorous men may hesitate to commit themselves to its principles, so large in their application; selfish men may shrink from the labor of change, which its recognition must entail; and wicked men may turn indifferently from considering that which concerns the health and happiness of millions of their fellow-creatures; but in the great objects which it proposes to itself, in the immense amelioration which it proffers to the physical, social, and, indirectly, to the moral condition of an immense majority of our fellow-creatures, it transcends the importance of all other sciences; and, in its beneficent operation, seems to embody the spirit, and to fulfil the intentions, of practical Christianity."[2]

In a subject of such vast importance, on which so little is generally known, and so much ought to be universally known, and which is so full of interesting and useful illustrations, it is difficult to confine ourselves within the limits of a single report of reasonable length. This great matter cannot, however, be presented so as to be understood, without some detail. And though we shall restrain any inclination to go into minute illustration, yet, in our judgment, it would be unworthy of Massachusetts, under whose authority we act, and it certainly would be unsatisfactory to ourselves, if we failed to make the attempt, at least, to present the subject so that the people of the state may know what we mean;

[1] The medical department of the National Institute have said, in the Transactions of the American Medical Association, Vol. I, p. 306, that "they had reasons to know, that the medical profession in this country, as a general rule, has many preconceived prejudices to overcome, in order to prepare it to enter into the inquiry with that spirit of philosophical research, which can alone make its deductions practically useful." We sincerely hope, however, that this prejudice does not extensively exist.

[2] "Report on the Sanitary Condition of the City of London," p. 38, by Dr. John Simon, Officer of Health; presented Nov. 6, 1849. To this valuable report we shall have occasion again to refer.

so that they may be able, if they choose, to carry our recommendations into practical operation; and so that, if thus applied, they will add to their physical power, and increase their intellectual, social, and personal happiness.

It should be borne in mind, however, that this report is designed to suggest a plan for a sanitary survey of the state, and not to contain the survey itself. We were authorized, however, by the resolve, to embrace a statement of such facts and suggestions as we might think proper to illustrate the subject. And as this is, in some respects, a report introductory to other useful information, which may hereafter be diffused, if our recommendations should be adopted, it has seemed to us that it would be instructive and proper here, to make a general survey of what has been suggested, and what has already been done on the subject, abroad and at home. Without such a view, we cannot wisely form a plan for our own guidance. We have accordingly been at no inconsiderable labor and expense to obtain the most recent authentic information concerning the history and present condition of the sanitary movement; and we shall proceed to give some of the results of the investigation, before presenting our plan for a sanitary survey of this state.

CHAPTER XVII

THE SANITARY MOVEMENT ABROAD

THE sanitary movement goes back to great antiquity, and is traced up to the direct revelation of the Supreme Lawgiver. "In the day that thou eatest thereof thou shalt surely die," may be regarded as the first sanitary as well as moral precept. And from that time, down through the patriarchal ages, there is evidence that the preservation of health was inculcated as one of the primitive duties. The sanitary laws revealed to the Jews constituted a part of their religion. The regulations for cleanliness, purification, protection from contagious diseases, and for the general preservation of health, are said to have been well adapted to the country in which they lived, and are still observed by the Arabs in that climate.

The advantages of public health were known in many of the cities of Greece, at the height of her civilization. The Spartans paid great attention to the physical education of young men and young women, and trained them to temperance, sobriety, and athletic exercises. Plato and Aristotle thought that no city could exist without health officers; and Epaminondas, Demosthenes, and Plutarch served in that capacity. Hippocrates, "the Father of Medicine," considered a knowledge of the causes of disease essential to the physician.

But the Romans were the most sagacious and extensive legislators in such matters. They were in many things masters of the practical; and have left vestiges still pregnant with the wisdom of experience. With them, nothing seems to have been deemed "common or unclean" that could protect the public health. We find Pliny writing to Trajan about a fetid stream passing through Amastris, as if it were an affair of state. The cloacae of the Tarquins are still among the architectural wonders of the world. The censors, ediles, and curators, who at different periods had charge

of the buildings, and of the apparatus for the removal of impurities, were invested with great powers for the execution of their functions, and derived a corresponding dignity from them. The arrangements for supplying the houses of Rome with water were most minute. Those for ventilation and drainage, still traceable in the several remains of Roman amphitheatres, have struck our most advanced sanitarians with surprise at their remarkable adaptation to their purpose.

The cause of public health received a fatal check, when Rome fell. What was previously known perished on the invasion of the barbarians, and in the general wreck of civilization. Some dietetic precepts, derived from the Greeks and Romans, were retained, but they were devoid of practical utility. It does not appear that any sanitary regulations existed, from the seventh to the fourteenth centuries. In those dark ages, the people lived without rule of any kind; and consequently, frightful epidemics often appeared, to desolate the land. Although so ancient, few subjects have since made so slow and so little progress, as the science of public health.

In France, in 1350, King John II established the first Sanitary Police; [1] and this has been considered the commencement of sanitary reform. The ordinance provided, that hogs should not be

[1] There are three terms which are sometimes used, when speaking of public health, — 1. Industrial Police; 2. Sanitary Police; and 3. Medical Police, — which it may be proper to define.

1. By Industrial Police is meant, the laws and regulations concerning the occupations of the people. Under it are included regulations for the location, and for preventing the location, of healthy or unhealthy trades; the hours of labor, etc., and the officers and agents by which they are controlled.

2. By Sanitary Police is meant, laws and regulations for the prevention of disease, and promotion of health. Under it are included the laws establishing, and the regulations of, boards of health; regulations for cleansing and purifying cities, villages, and private establishments; removal of nuisances, burying the dead, etc.; and the officers or agents by which these matters are carried forward.

3. By Medical Police is meant, laws and regulations for the cure of disease. Under it are included laws prescribing the qualifications and duties of physicians, apothecaries, mid-wives, etc.; the regulations for their own government among themselves; and the officers and agencies by which they are controlled.

Industrial, sanitary, and medical police exist in nearly all the governments on the continent of Europe, and will be illustrated to some extent in this report. Those who wish more particular information on these matters are referred to the lists of

kept in cities; that streets should be cleansed, and the offal removed; that butchers should not sell meat more than two days old in winter, and one and a half in summer; and that fish should be sold the same day they were caught. Ordinances in 1486 and 1497 excluded potteries from the centre of Paris. Soap is said to have been unknown, until the fifteenth century. In 1657, and at later periods, tan-yards, dye-houses, and like establishments, were required to be located out of the towns, and near the water. Henry IV quieted the people of Paris, who were alarmed at the use of English coal, by obtaining from the physicians a declaration that no harm could come of it. L. Reyn consulted the physicians on the manufacture of bread. Instructions were given, but unfortunately they were not carried out. The greatest number of houses, in cities, had no privies, in the sixteenth century. The ancient parts of cities show that the streets were narrow and crooked, and the houses low, damp, and without light or air. Paving and lighting the streets are modern inventions. The last part of the eighteenth century wrought some improvements, but public health did not become a well-ordered measure, until the commencement of the nineteenth century.

The first permanent "Conseil de Salubrité," — Council of Health, — designed especially for the city of Paris, was established by Dubois, the Prefect of the Police, on the 6th July, 1802, and was modified by new decrees in 1810 and 1815. The services of this council are rendered gratuitously, yet it has been considered a great honor to belong to it.[1] It was at first composed of four members, — but has since been increased to twenty-four, besides the president and secretary.

This council is merely consultative. Its advice, in all matters submitted to it, is considered and acted upon by the administration. Its labors and decisions are, however, held in so high esti-

books and articles in the appendix; and also to the German work, "Frank (*Johann Peter*) System einer vollstaendigen medicinischen Polizey": Complete System of Medical Police, 6 vols., 8vo; to an article on Medical Police, in the Westminster Review, Vol. XLV, for 1846, p. 56; and to the works there reviewed. Also, Transactions Am. Med. Association, Vol. II, p. 326.

[1] See "Traité de la Salubrité," pp. 23 and 25; also, pp. 319–359, where the ordinances appear. "Annales d'Hygiène publique," tome I, p. 13.

mation, that they are seldom if ever reversed. Their reports were published annually, until 1828, when they were discontinued. In 1840, a general report of their labors for the eleven years, 1828–1839, was published; and, in 1847, another report for the six years, 1840–1845.

These reports relate to three great divisions, — health, salubrity, and industry. Under health are classed, among other things, the researches on the adulteration of food, on the vessels used in its preparation, on the precautions to be taken with respect to the vessels and utensils of copper, regard being had to the uses for which they are employed; the experiments on the adulteration of salts, on the adulteration of bread and of flour by different substances, on the poisonous substances employed to color bonbons, liqueurs, etc.; the examination of the methods employed in preparing pork; the examination of the water used for drink; the adulteration of the flours of linseed and mustard; the use of meat of animals which had died of disease; the researches into the salubrity of dwellings. The head of salubrity comprises the anatomical theatres, their construction, the means of remedying the causes of the unhealthiness which these establishments present; the discharge of sulphurous waters from the public baths, the utility of street fountains, the inspection of barracks, and the sanitary measures to which they should be subject; the improvements to be made in the fires of the establishments which employ coals; the arrangements to be made for the deposit of filth in the rural districts; the purification of sewers; the supply of water for domestic and industrial purposes; the steps to be taken in exhumations; the examination of different contrivances to empty privies, the ameliorations to be introduced into this portion of service; the wholesomeness of the markets; the inspection of prisons. The reports which relate to industry principally treat of the construction of slaughter-houses; the condensation of the gas and vapors resulting from the refining of metals; the fabrication, preservation, and sale of fulminating and lucifer matches; the precautions to be taken in the construction of fulminating powder-mills, and in the manipulation of the substances employed there; the measures to be taken for the conveyance of the fulminate of

mercury; the researches into the employment of bitumens, and the conditions to be prescribed to the makers; the making of wax candles; the conditions to be imposed on catgut factories; the researches on the fires of wash-houses, and on the necessity of decomposing the soapy water to prevent putrefaction; the sanitary measures applicable to white-lead manufactories, and the researches on the diseases of the workmen; the propositions of classification for different trades, such as the silk hat factories, the forges, the places for making and keeping ether; and the beating of carpets.

Thus health, salubrity, industry, offer to the "Conseil de Salubrité" a vast field of researches and investigations, and we may affirm that there is no question relating to these three great departments of the administration, which they have not profoundly meditated, and in part resolved. If now we turn to other subjects, we still find important labors which touch in several points on the different matters of which we have just spoken, but which have not, like them, a special and clearly defined character: such are the reports on epidemics and smallpox; the measures to be taken to prevent or combat them; the epizootics that have prevailed at different epochs among several species of animals, and particularly among milking cows; the sale of horses with glanders, and the regulations to which they should be subject, as well as other animals seized with contagious diseases; the measures to be taken against rabid dogs, and the precautions in case of bites from these animals; the modelling, examination, and embalming of corpses; the aids to be afforded to the drowned and suffocated; the measures to be taken to ascertain the number of these accidents, as well as of suicides; the compilation of a new nomenclature of diseases and causes of death; the measures to be taken to prevent fires in theatres, and various other matters.

In the German and Prussian states, systems of sanitary and medical police exist in greater perfection, and have been applied more extensively to society, than in any other parts of the world. They are under the control of government, and especially the Home Secretary or Minister of the Interior, by means of a central medical department, the director of which is a kind of under-

secretary of state. This department consists of three physicians, two apothecaries, and two veterinary surgeons. A registrar and library are attached to it, the latter containing, among other documents, copies of the laws relating to sanitary or medical police by foreign governments. Besides these there is a scientific council of health, composed of those practitioners who have attained to professional eminence, whose duty it is to advise the Executive. Subordinate to these are provincial boards and councils, the director of which, termed medicinal rath, superintends the medical police of his province, and is assisted by the medical superintendent (kreis-physici) of districts, corresponding to our counties.

In Great Britain, the sanitary welfare and improvement of the people seems to have attracted very little attention until within the last twenty-five years. Boards of health had existed in many cities, but they were generally void of much vitality. The report from the select committee of the House of Commons, on the laws relating to Friendly Societies, was published July 5, 1825; and a second report on the same subject, June 29, 1827. In the *Westminster Review* for April, 1828, there appeared an able article on the matters suggested in these reports, the object of which was " to exhibit the present state of the information possessed relative to the casualties of sickness and mortality, and the conduct of the government respecting the departments of the public expenditure appropriated as means to diminish the evil effects of these casualties." These works have been considered as the dawning twilight of sanitary improvement.

The review was written by Edwin Chadwick, Esq., of the Inner Temple, barrister-at-law, the individual to whom, perhaps, more than to any other, the cause is indebted. A leading London periodical, of December, 1849, has described him as then " a student at law in the Temple. He was not a man of varied or profound attainments, nor distinguished by any extraordinary brilliancy of intellect. But he was remarkable for his sagacity in extracting from masses of detail the master facts, and bringing these to bear for the elucidation of a master thought. He would confront, undaunted, any amount of intellectual labor; exploring

mountains of blue books and statistical returns, till he had fully ascertained and brought to light their true riches. For some years his peculiar powers had been wasted on sifting evidence in private cases for attorneys. But in 1828, a slight incident threw the idea of which we have spoken across his track. He seized it, and it became the ruling thought of his life." His name should be handed down to posterity as one of the greatest and most useful reformers of his age.

In 1838, the Poor-Law Commissioners instituted inquiries into the effects of different methods of managing pauper children; and the results of their inquiry appeared in 1841, in a " Report from the Poor-Law Commissioners on the Training of Pauper Children." This work contains several valuable papers relating to health, as well as education in general.

A " Report on the Prevalence of certain Physical Causes of Fever in the Metropolis, which might be removed by proper Sanitary Measures; by Neil Arnott, M.D., and James Phillips Kay, M.D.," dated 12th May, 1838; and another " Report on some of the Physical Causes of Sickness and Mortality to which the Poor are particularly exposed, and which are capable of removal by Sanitary Regulations; exemplified in the present condition of the Bethnal Green and Whitechapel Districts, as ascertained on a personal inspection by Southwood Smith, M.D., Physician of the London Fever Hospital," dated May, 1838, were published in the *Fourth Annual Report of the Poor-Law Commissioners* (8vo ed., pp. 103, 129), and also in a separate form. And a " Report on the Prevalence of Fever in Twenty Metropolitan Unions or Parishes, during the year ending the 20th March, 1838, by Southwood Smith, M.D.," was published in the *Fifth Annual Report* (p. 160).

In consequence of these reports, Lord John Russell, then Secretary of the Home Department, on motion of the Bishop of London, addressed a letter to the commissioners, dated August 21, 1839, directing them to inquire " as to the extent to which the causes of disease, stated in these reports to prevail among the laboring classes of the metropolis, prevail also among the laboring classes in other parts of England, Scotland, and Wales." The

commissioners began this inquiry through the agency of their secretary, Edwin Chadwick, Esq., in November, 1839; and that distinguished sanitary reformer digested the information obtained; and presented his very able and most valuable report, July 9, 1842, which was published under the title, "Report on the Sanitary Condition of the Laboring Population of Great Britain, by Edwin Chadwick, Esq."

The facts thus far developed began to make a profound impression upon the public mind; and Sir Robert Peel, foreseeing their importance, on the 9th May, 1843, appointed another commission, consisting of thirteen gentlemen of eminence, to inquire "into the present state of large towns and populous districts in England and Wales, with reference to the causes of disease among the inhabitants; and into the best means of promoting and securing the public health under the operation of the laws and regulations now in force; and the usages at present prevailing with regard to the drainage of lands, the erection, drainage, and ventilation of buildings; and the supply of water in such towns and districts, whether for purposes of health, or for the better protection of property from fire; and how far the public health and the condition of the poorer classes of the people of this realm, and the salubrity and safety of their dwellings, may be promoted by the amendment of such laws, regulations, and usages."

This commission made their first report, June 22, 1844, and their second report, February 3, 1845. These works contain 1363 folio pages, besides numerous maps, and other pictorial illustrations; embracing an immense mass of facts on the subjects to which they relate. Two editions have been published: one in two volumes, large folio, and the other slightly abridged, in four volumes octavo, under the title of "Reports of the Commissioners for inquiring into the state of Large Towns and Populous Districts." These reports have been justly characterized as "certainly among the ablest and most comprehensive state papers that ever issued from a government office."

September 24, 1847, another commission, consisting of Lord Robert Grosvenor, Edwin Chadwick, Thomas Southwood Smith, Richard Owen, and Richard Lambert Jones, was appointed to

inquire " whether any and what special means may be requisite for the improvement of the health of the metropolis, with reference more particularly to the better house, street, and land drainage; street cleansing and paving; the collection and removal of soil and refuse, and the better supply of water for domestic use, for flushing sewers and drains, and cleansing streets; and also, to the best means of using existing works, and of erecting new works requisite, and of maintaining them in good action; and also, to the most equitable provisions for regulating the charges, or assessing, collecting, and paying the moneys requisite for such purposes, more especially in the districts chiefly inhabited by the poorer classes of the population." They made their first report, November 19, 1847; their second, February 19, 1848; and their third, July 13, 1848.

On the 31st of August, 1848, the great measure which had been brought into Parliament by Lord Morpeth (now Earl of Carlisle) became a law, under the title of " An Act for promoting the Public Health." Under this act a General Board of Health has been organized, consisting of the Earl of Carlisle, Lord Ashley, Edwin Chadwick, Esq., and Thomas Southwood Smith, M.D. Henry Austin, Esq., is their secretary.

While these various governmental measures were in progress, the people were not inactive. Public opinion kept ahead of public measures. In November, 1844, an important meeting was held at Exeter Hall, composed of some of the ablest men in the kingdom, which formed the " Metropolitan Health of Towns Association." April 23, 1845, the " Liverpool Health of Towns Association " was organized; and soon after, similar associations were formed in the principal towns in England. A monthly periodical work, entitled *The Liverpool Health of Towns Advocate*, was commenced Sept. 1, 1845, and continued until July 1, 1847. In November, 1847, the *Journal of Public Health, and Monthly Record of Sanitary Improvement*, was commenced in London, and was continued until December, 1849, under the management of the Metropolitan Association. The books, pamphlets, and documents, official and private, which have more recently appeared on the subject, and the different sanitary movements that have been made for the

public benefit, are too numerous to be specified. The whole country seems to be interested; and the people, with some few exceptions, view the sanitary questions as The Great Idea of the Age. Able articles have, from time to time, appeared in the leading periodical reviews, miscellaneous as well as medical; and among other newspapers, *The Times*, and *The Morning Chronicle*, the leading journals of the world, have been its powerful advocates. *The Times*, during nearly the whole of last year, teemed with able articles. *The Chronicle* commenced, on the 18th of October, 1849, three series of most valuable papers on "Labor and the Poor"; one relating to the metropolitan districts, one to the manufacturing districts, and one to the rural districts.

Even the Queen, in her recent speech at the opening of Parliament, recommended the subject to public consideration:

> In the summer and autumn of the past year, the United Kingdom was again visited by the ravages of the cholera; but Almighty God, in his mercy, was pleased to arrest the progress of mortality and to stay this fearful pestilence. Her Majesty is persuaded that we shall best evince our gratitude by vigilant precautions against the more obvious causes of sickness, and an enlightened consideration for those who are most exposed to its attacks.

It would be impossible here to give even an analysis of these documents and works. The following are among the many conclusions to which we are led from the information they contain:

1. It is proved that there die annually, in each 100 of the population, of the whole of England, 2.27; of the most healthy district, 1.53; and of the most unhealthy district, 3.58. And that the living to one death are, in these districts, respectively, 44, 65, and 27.

2. It is proved "that the various forms of epidemic, contagious, and other diseases, caused, or aggravated, or propagated, by atmospheric impurities, produced by decomposing animal or vegetable substances, by damp and filth, and close and overcrowded dwellings, prevail amongst the population in every part of the kingdom, whether dwelling in separate houses, in rural villages, in small towns, or in the large towns, as they have been found to prevail in the lowest district of the metropolis."

3. It is proved that disease and mortality fall more heavily upon those who live in large towns and populous places, than in

the country districts, and particularly upon those who live in narrow streets, confined courts, damp dwellings, close chambers, cellars, undrained, unventilated, and uncleansed; and affect most severely the infantile portion of the population, and the heads of families between twenty and thirty years of age.

4. It is proved that, in such situations, the average duration of life is five to twenty-five years less than it might otherwise be; and that, during this curtailed period of existence, the working power of those who live, and their capacity for enjoyment, are greatly diminished by a constant depression of health and spirits, and by the active attacks of fever, cholera, scrofula, and consumption.

5. It is proved " that such diseases, wherever their attacks are frequent, are always found in connection with the physical circumstances above specified; and that where these circumstances are removed by drainage, proper cleansing, better ventilation, and other means of diminishing atmospheric impurity, the frequency and intensity of such diseases are abated; and where the removal of the noxious agencies, and other causes of disease, appears to be complete, such diseases almost entirely disappear."

6. It is proved that the annual mortality might be reduced, in the whole kingdom, from 2.27 per cent, or 1 in 44, to less than 2 per cent, or 1 in 50; and in all large towns, as low as that general average.

7. It is proved that this unnecessary excess of mortality above 2 per cent occasions an annual loss of more than 50,000 lives in the United Kingdom, — " greater than the loss from death or wounds in any wars in which the country has been engaged in modern times"; and that the causes of these unnecessary deaths occasion at least twenty cases of unnecessary sickness, on the average, to each death, or one million cases annually, which might have been prevented.

8. It is proved that of the 43,000 cases of widowhood, and 112,000 cases of destitute orphanage, relieved from the poor rates of England and Wales alone, the greater proportion of deaths of the heads of families occurred from specified removable causes; and that the average of their ages was under forty-five years, or

thirteen years below the natural probability of life, as shown by experience.

9. It is proved that the preventable causes of disease, and the unnecessary mortality, impose upon the people immense pecuniary burdens which might be avoided.

10. It is proved that the younger population, bred up under noxious physical agencies, is inferior in physical organization and general health to a population preserved from such agencies; and that these adverse circumstances tend to produce an adult population, short-lived, improvident, reckless, intemperate, immoral, and with excessive desires for sensual gratifications.

CHAPTER XVIII

THE SANITARY MOVEMENT AT HOME

Sanitary Police. Some historical notice of the sanitary legislation of Massachusetts seems proper, preliminary to any statements of its present condition. We have accordingly presented, in the appendix,[1] the titles of all the acts relating to matters connected with the public health, from the commencement of the provincial charter, in the year 1692, to the present time, arranged in chronological order; and referred, in connection, to the printed works where they may be found. The subject seems to have received little attention from the General Court, during the old colonial charter.[2] Two acts, which have some relation to it, we

[1] See Chapter XXI.

[2] Towns, however, under the general authority which they possessed, sometimes made regulations regarding sickness. The selectmen of Salem, in 1678, "ordered that William Stacy, who is sick of the small-pox, doth not presume to come abroad till three weeks after this date; and that he be very careful that when the time be expired he shift his clothes, and do not frequent company till he be wholly clear of the infection." And again — "The selectmen being informed that William Lord, Jr., is visited with the small-pox, at his father's house, do order that William Lord, sen., his wife and children that live with him, do keep within their house, and that they do not offer to sell any of their wares, viz.: bread, cakes, gingerbread, and the like; and that they suffer none to come to their house, but what necessity requires, upon the penalty of 20*s.* in money for each offence. It is ordered that Thomas Stacey doth forbear grinding at the mill, and that he be careful he doth not infect others, on the penalty of 20*s.* A house is ordered to be impressed for our sick, having the small-pox." — *Felt's Annals of Salem*, Vol. II, p. 423.

The following act was passed by the Massachusetts Colony, in 1660:

"This court, considering how far Satan doth prevail upon several persons within this jurisdiction to make away themselves, judgeth that God calls them to bear testimony against such wicked and unnatural practices, that others may be deterred therefrom:

"Do therefore order, that from henceforth, if any person, inhabitant or stranger, shall at any time be found by any jury to lay violent hands on themselves, or be wilfully guilty of their own death, every such person shall be denied the privilege of being buried in the common burying-place of Christians, but shall be buried in some common highway, where the selectmen of the town where such person did inhabit shall appoint, and a cart-load of stones laid upon the grave as a brand of infamy, and as a warning to others to beware of the like damnable practices." — *Ancient Charters and Laws*, p. 187.

shall presently notice. Laws were passed by the provincial government, relating to nuisances, drainage, smallpox, and some other matters; many of which were special acts, or partial in their operation. But though imperfect, they are honorable to the state, and exhibit the care which the Legislature has ever wished to exercise over the people. To them we have been indebted for many excellent sanitary municipal regulations, which have continued until the present time.

Nuisances. In 1692 and 1708, acts were passed, providing that " in Boston, Salem, Charlestown, respectively, and other market towns in the province," " slaughter-houses for killing of meat, still-houses, and houses for the trying of tallow, currying and dressing of leather, either with lime, alum, or oil, be assigned by the selectmen to places where it may be least offensive," and prohibited elsewhere; and records were to be kept of such assignment. The provisions of these acts were incorporated into that of June 7, 1785, and then extended to Newburyport, and other towns in the state, in which the selectmen and two justices might judge it to be necessary; and included earthenware in the list of manufactures to be regulated. A fine of £5 was imposed for a breach of the law, which, by the additional act of March 4, 1800, was fixed at $20. The Revised Statutes modified this act, and extended its provisions to any town in the state, at the option of the selectmen, and included " any trade or employment offensive to the inhabitants, or dangerous to the public health."

Drainage and Sewerage. In 1702, an act was passed providing " for appointing commissioners of sewers, for the draining and removing of the banks and obstructions of the passage of waters in rivers, brooks, or ponds that occasion the overflow and drowning of meadows and low lands; and also for the draining and flowing of swamps and other unprofitable grounds, and drying of them." Another act, " for regulating drains and common shores " [sewers], was passed in 1709, placing them under the direction and control of the selectmen of the town. These provisions were incorporated into the two laws of the state, passed Feb. 26, 1796, and Feb. 20, 1797, and remained in force until their repeal in 1836, when they were re-enacted in the modified form of the Revised Statutes.

Sickness. Legislation on this subject, principally with reference to the smallpox, has been frequent in the history of the state. As early as 1701, " an act providing in case of sickness," was passed, " for the better preventing the spreading of infection." By this act, when persons " were visited with the plague, smallpox, pestilential or malignant fever, and other contagious sickness, the infection whereof may be communicated to others," the selectmen were empowered, " for the preservation of the inhabitants," to remove such infected persons to separate houses, and to provide " nurses, tendance, and other assistance and necessaries for them, at the charge of the parties themselves, their parents or masters (if able), or otherwise at the charge of the town or place whereto they belong." And the sheriff of the county, his deputy, or the constable of the town, were required, under direction of the selectmen, " to impress and take up convenient housing, lodging, nurses, tendance, and other necessaries for the accommodation and relief of the sick." And if a vessel arriving in the province happened " to be visited with the plague, smallpox, pestilential or malignant fever, during the voyage, or to come from any place where such sickness prevailed," they were authorized to prevent all persons belonging to the ship coming on shore, or those on shore having any intercourse with them. This has been the foundation of all the sanitary laws passed since that time. Its provisions were retained and much extended in the great act of June 22, 1797, which was the most important sanitary act passed in the United States, prior to the passage of the Massachusetts registration laws.

The smallpox has often prevailed in the state as an epidemic, and legislation to guard against its effects has been frequent. In 1730, an act was passed, " empowering courts to adjourn and remove from the towns appointed by law for holding courts, to other towns, in cases of sickness by the smallpox." Another act was passed, in 1751, respecting clothing and other goods supposed to be infected, containing almost the same provisions as were re-enacted in 1797, and incorporated into the Revised Statutes in 1836. Other acts respecting the smallpox were passed in 1742, 1757, 1776, 1777, 1792, and 1793. On the 6th of March, 1809, an

act was passed, making it the duty of towns to choose a committee to superintend the vaccination of the inhabitants. This excellent law was so modified, improperly as we think, in the Revised Statutes, as to leave it to the discretion of the selectmen, to act or not to act under its authority, as they might choose.

Insanity. In 1694, towns were required to provide for the "relief, support, and safety" of persons "naturally wanting of understanding, so as to be uncapable to provide for him or herself, or by the providence of God shall fall into distraction, and become non compos mentis." Acts "for suppressing rogues, vagabonds, common beggars, and other idle and disorderly and lewd persons," were passed in 1758 and 1798, by which justices were empowered to commit insane persons to the house of correction. These acts were repealed in 1834, though some of their bad features are still retained. It seems to us that, unless crime has actually been committed, insane persons should not be treated as criminals, but should be restrained and provided for by some other tribunal than a criminal court.

Quarantine. We have already alluded to one law, partially quarantine. In 1700, the masters of ships were required to furnish a list of all passengers to the selectmen of towns, and give security for the support of any "impotent, lame, or infirm person" who might be discharged. At a subsequent period, not exactly known, a hospital was erected on Spectacle Island, by the town of Boston; and, in 1736, an arrangement was made between Boston and the Commonwealth, for a permanent quarantine establishment on Rainsford's Island. No hospital, however, appears to have been erected until some time afterwards. In 1757, "An Act for regulating the Hospital on Rainsford's Island, and further providing in case of sickness," was passed. This act commences, "Whereas a good and convenient house hath been provided at the charge of the province, on the island called Rainsford's Island, for the reception of such persons as shall be visited with any contagious sickness"; and then follow the general provisions of law on the subject. An additional act was passed in 1758; and in 1799 the whole quarantine regulations were transferred to the Boston Board of Health; and there it rested, as

it always should have done, until the Revised Statutes were passed.

Special Legislation. The first Board of Health in the state was established in Boston, by a special act of the Legislature, passed February 13, 1799. This first act was, however, repealed, and another, more comprehensive and extended, was passed in its stead, on the 20th of June in the same year. This act contains twenty-five sections, and has since formed the basis of our special legislation. Besides its own provisions, it imposed upon the board all the powers and duties of the general act of June 22, 1797. Additional acts were passed in 1803, 1804, 1806, 1809, and 1810. In the last-named year, the Board of Health were authorized to make rules and regulations for burial grounds, and for the interment of the dead; and under that act, in that year, was commenced the excellent plan of recording the name, age, and disease of every person buried; which records have been continued until the present time. June 20, 1816, a revised act for establishing the Board of Health, drawn by Benjamin Whitman, Esq., was passed, and repealed so much only of the previous acts, as were inconsistent with its provisions. By the city charter, all the powers of the Board of Health were "transferred to and vested in the city council."

Boards of Health have since been established in other places, according to the following statement:

Towns	When Established	History
Boston,	Feb. 13, 1799.	Transferred to City Council, Feb. 23, 1822.
Salem,	June 21, 1799.	" " " March 23, 1836.
Marblehead,	Feb. 22, 1802.	Still existing in the town.
Plymouth,	Feb. 27, 1810.	" " " "
Charlestown,	June 12, 1818.	Transferred to City Council, Feb. 22, 1847.
Lynn,	June 16, 1821.	" " " April 10, 1850.
Cambridge,	March 2, 1828.	" " " March 17, 1846.

A notice of the Medical Organization, the professional efforts, and the means for the cure of disease, which have existed in the state, form a part of the history of the sanitary movement. Previous to the formation of the Massachusetts Medical Society, medicine had been recognized rather as an art than as a science. Little or no public instruction on the subject of medicine had been

given. The profession was indeed recognized as distinct, and there had been several physicians of eminence.[1] Clergymen, however, at that early period, frequently prescribed for the diseases of their brethren; and although they were not endowed with high attainments in medical science, they were nevertheless qualified for great usefulness in their respective stations.

The Medical School connected with Harvard University was founded in 1783, though the first degree was not conferred until 1788. Degrees were conferred upon 25 persons, prior to 1800; upon 124, from 1800 to 1820; upon 393, from 1820 to 1840; and upon 259, from 1840 to 1850.

The Berkshire Medical School, at Pittsfield, was incorporated in 1823, and probably more than 700 have since graduated.

[1] Laws in the Old Colonies. The following acts, relating to the practice of physic, appear among the laws of the old colonies, and are the oldest acts on the subject in the United States. The first was passed in Plymouth, in 1642; and the second in Massachusetts, in 1649:

1. "If any children or elder persons shall be sent or come from one town to another, to be nursed, schooled, or otherwise educated; or to a physician, or chirurgeon, to be cured of any disease or wound, etc.: if they come to stand in need of relief, they shall be relieved and maintained by the townships whence they came, or were sent from, and not by that township where they are so nursed, educated, or at cure; and in case they come or be sent from any town or place out of this colony, then if the nurse, educator, physician, or chirurgeon, take not sufficient security of the person to be nursed, educated, or cured, to discharge the township of and from all cost and charge which shall or may come and befall the said township in which he or they is so to be nursed, educated, or cured: then they the said nurse, educator, physician, or chirurgeon, as neglects the same, shall discharge the said township of them themselves."—*Plymouth Colony Laws*, p. 72.

2. "Forasmuch as the law of God allows no man to impair the life or limbs of any person, but in a judicial way:

"It is therefore ordered, that no person or persons whatsoever, employed at any time about the bodies of men, women, or children, for preservation of life or health, as chirurgeons, midwives, physicians, or others, presume to exercise or put forth any act contrary to the known approved rules of art, in each mystery and occupation, nor exercise any force, violence or cruelty upon or towards the body of any, whether young or old (no, not in the most difficult and desperate cases), without the advice and consent of such as are skilful in the same art (if such may be had), or at least of some of the wisest and gravest then present, and consent of the patient or patients, if they be mentis compotes, much less contrary to such advice and consent, upon such severe punishment as the nature of the fact may deserve; which law, nevertheless, is not intended to discourage any from all lawful use of their skill, but rather to encourage and direct them in the right use thereof, and inhibit and restrain the presumptuous arrogancy of such as, through prefidence of their own skill, or any other

The Boylston Medical School, incorporated in 1847, and the Tremont Medical School, formed in 1838, and incorporated in 1850, are located in Boston. These schools are entirely independent of that connected with Harvard University, and they receive students at any time.

It is said, by those who are familiar with the medical schools in Europe and this country, that few places can be found where greater facilities exist for obtaining a thorough education than in Boston; whether we consider the high character of the scientific instruction given, the opportunities of witnessing the practical application of those principles, the ease with which subjects are obtained, or the expenses incurred.

Schools for instruction in other modes of practice have also been formed in the state.

Various medical associations for improvement in medical science and medical practice; and public hospitals, and other public institutions for the cure of disease, are to be found in the state, in as good condition as in any other part of the world.

The medical literature of the state has had considerable influence upon the health of the inhabitants. It was stated in 1810, as a remarkable fact, that "twenty-seven foreign medical books had been republished in Massachusetts!" [1]

The *Medical Repository*, the first periodical work devoted to medicine in the United States, was commenced in New York in 1797. The *New England Journal of Medicine and Surgery* was commenced in Boston, in 1812, and continued until 1827. The *Boston Medical Intelligencer*, edited by Dr. J. V. C. Smith, was commenced in 1822, and was published weekly until 1828. The two latter works were united; and, on the 19th of February, 1828, the first number of the *Boston Medical and Surgical Journal* was issued in their stead, which has since been continued, under the editorial charge of Dr. Smith. The *Boston Medical Magazine*, commenced in 1831, and the *New England Quarterly Jour-*

sinister respects, dare boldly attempt to exercise any violence upon or towards the bodies of young or old, one or other, to the prejudice or hazard of the life or limb of man, woman, or child." — *Ancient Charters and Laws*, p. 76.

[1] Communications, Massachusetts Medical Society, Vol. II, p. 265. See New York Journal of Medicine, for March, 1850.

nal of Medicine and Surgery, commenced in 1842, were each discontinued after the first volume was published.

These periodical publications, and several separate works and essays, contain some facts concerning the prevalence of epidemic and other diseases in Massachusetts, though they are very imperfect and disconnected. They, however, show the great value of more complete and thorough investigation and knowledge.

Sanitary History of the State. This should be known; for the knowledge might suggest the remedial measures proper to be adopted; and we deem it proper, in this connection, to refer briefly to some of the facts which we have gleaned on the subject.

In 1618, two years before our forefathers arrived at Plymouth, there appeared, among the Indians of the country, one of the most remarkable epidemics of which we have an account. So fatal was the pestilence, that the warriors "were reduced from nine thousand to a few hundreds." The Massachusetts tribe alone was supposed to have lost 2,700 out of 3,000 persons. In 1621, many places which had been populous Indian villages were found "all deserted — all dead." The bones of those who perished were lying unburied. Hutchinson says some have supposed the disease to have been the smallpox; but from the Indian account we might infer otherwise. Gookin says, "What the disease was which so generally and mortally swept them away, I cannot learn. I have discoursed with some old Indians that were then youths, who say that the bodies all over were exceeding yellow (describing it by a yellow garment they showed me), both before they died, and afterwards." It has been inferred from this that it was the yellow fever; but whether correctly or not seems undetermined.[1]

1621. At the commencement of the settlement of Plymouth, our venerable ancestors suffered severely from sickness. At the end of three months after their arrival, fifty-five only survived of the one hundred and one who came in the *Mayflower*. "The sick were destitute of almost all the comforts which their miserable condition rendered indispensable. Their sufferings were increased

[1] Mass. Historical Collection, Vol. I, p. 143; Hutchinson's Hist. Mass., Vol. I, p. 34.

by the want of well persons to perform the duties among the sick; there being, at one time, not more than six or seven persons in tolerable health." [1]

1631. The smallpox, first breaking out at Saugus, spread from Narragansett to Piscataqua, and westward to Connecticut River, and swept off entire villages of the Indians. When Increase Mather wrote, there were living some old residents, who on that occasion helped to bury whole families of the natives at the same time.

1633. At the close of this year the smallpox again broke out, and made great devastations among the unfortunate native races of Massachusetts. Chickatabut, the great sachem of the tribe, was among the victims.

1634. Plymouth was again visited with a mortal sickness, of which twenty men, women and children died; among whom was that most excellent and pious man, Dr. Samuel Fuller, the first physician of New England. "It must have been occasioned by a fever of domestic origin, as the colony had at that time no intercourse with foreign countries, except England."

1639 was sickly in the colonies, and a general fast was observed on account of the smallpox and fevers.[2]

1645. Great sickness prevailed among the Indians at Martha's Vineyard. Few escaped.

1647. A malignant fever prevailed, "occasioned by the excessive heat of summer"; and an epidemic influenza passed through the whole country, and universally affected the colonists and natives; but it was not very mortal: "wherein a special providence of God appeared, for not a family nor but a few persons escaping it; our hay and corn had to be lost for want of help; but such was the mercy of God to his people, as few died — not above forty or fifty in Massachusetts, and near as many at Connecticut." [3]

1654. A general fast was appointed, on account of "the mortality which had been among the people of Massachusetts": what the disease was does not appear.

[1] Thatcher's Hist. Plymouth, p. 32.
[2] Webster, Vol. I, p. 187.
[3] Winthrop's Journal, II, p. 310.

1655. Another epidemic distemper, similar to that of 1647, passed through New England. It began in June, and few persons escaped. Among those who died was Rev. Nathaniel Rogers, of Ipswich.

1658. Sickness and mortality throughout New England.

1659. Croup is first mentioned in the annals of the country. Other malignant diseases also prevailed about this time. Thirty children died in Rowley. A day of thanksgiving was appointed in Connecticut, for the " abatement of the sickness in the country, and a supply of rain in time of drought."

1668 was a year of great sickness, though few facts are preserved concerning its extent. In New York a public fast was held on account of it.

1677. Smallpox was very fatal in Charlestown. The records state that thirty-one died of the disease, one of whom was the Rev. Thomas Shepard.

1678. Smallpox in Boston; but we have seen no account of its victims.[1] Seven or eight hundred are said to have died of it in the state. About this time " the seasons were unfavorable, and the fruits blasted while malignant diseases prevailed among the people. The sickness and bad seasons were attributed by our pious ancestors to the irreligion of the times, and to their disuse of fasting; and a meeting was held to investigate the causes of God's judgments, and to propose a plan of reformation." [2]

1697–98. The influenza began in November, and prevailed until February, in Massachusetts. Whole families and whole towns were seized nearly at the same time. In the same year, a " mortal disease prevailed so much, in Fairfield, Connecticut, that well persons were not found to take care of the sick and bury the dead." Seventy died in three months, out of a population of less than one thousand. At the same time, a dreadful mortality occurred in Dover, New Hampshire. Rev. Dr. Mather said, in a sermon preached in Boston, in 1698: " The smallpox has four times been a great plague among us. Often have one hundred bills, desiring prayers for the sick, been read in one day, in one of our assemblies.

[1] Felt: Annals of Salem, Vol. II, p. 423.

[2] Webster, Vol. I, p. 203.

In one twelvemonth about one thousand of our neighbors have been carried to their long home."

1702. Smallpox in Boston: two hundred and thirteen, exclusive of blacks, died; about 4.4 per cent of the inhabitants. It began in June, 1702, but the first death was in August of that year. In September, it became very mortal, and was attended with a fever resembling the scarlet fever. In October many died. The General Court sat at Cambridge, and they passed the first law for protection against the smallpox already noticed. It began to subside in February, 1703.[1]

1715. Plymouth lost forty of its inhabitants by a malignant disease, but no particulars are known.[2]

1717–18. From November to February, " a very malignant and mortal distemper " prevailed in Concord. Twenty-seven persons, chiefly heads of families, died; many very suddenly. The disease is not named in the record.[3] A fast was held in Danvers, February 13, on account of a fatal disease that prevailed at the village, which threatened at one time to sweep away the entire population.[4]

1721. The smallpox again made its appearance in Boston, with more than its usual ravages and horrors, and was the occasion of one of the most remarkable and important events in the sanitary history of the state. Inoculation with the virus of smallpox, as a substitute for the disease taken in the natural way, — to disarm it of its malignity, and to reduce it to comparative mildness and safety, — was first introduced this year. Rev. Dr. Cotton Mather, having read, in the *Transactions of the Royal Society of London*, favorable accounts of the operation, recommended a trial of it to the physicians of Boston; but all of them unanimously and decidedly opposed it, excepting Dr. Zabdiel Boylston. That enlightened and upright man became forcibly impressed with the importance of the discovery; and, to show his confidence in it, made the first experiment on his own son, thirteen

[1] Webster, I, p. 216.
[2] *Ibid.*, I, p. 224.
[3] Shattuck's History of Concord, p. 223.
[4] History of Danvers, p. 42.

years of age, and two colored persons in his family, one two, and the other thirty-six years old; and all with complete success. Subsequently, others were inoculated.

The controversies, which accompanied the introduction of this useful measure, were most disreputable. Many persons were struck with horror; some thought it was sinning against God, thus to interfere with the disease; and others that, if any patients died, Dr. Boylston ought to be treated as a murderer. Pamphlets and newspaper articles frequently appeared; and the populace, chiefly led on by the inflammatory conduct of the physicians, at the head of whom was Dr. Douglass, became so exceedingly enraged, that Dr. Boylston was frequently insulted in the streets, and forced to secrete himself for more than fourteen days, and afterwards to visit his patients only at midnight. His family were hardly safe in his own house. Passion and prejudice on the one side, however, were met with decision and success on the other; and inoculation soon triumphed over opposition, and became general.[1]

[1] Those who may wish to investigate this curious subject are referred to a volume of these pamphlets, preserved in the library of the Massachusetts Historical Society; and to Thatcher's American Medical Biography, Vol. I, pp. 20, 185, 255, where will be found notices of Drs. Boylston and Douglass.

Douglass had his prejudices and eccentricities. In his "Summary," published in 1753 (II, p. 351), he wrote as follows of the medical profession: "In general, the physical practice in our colonies is so perniciously bad, that excepting in surgery, and some very acute cases, it is better to let nature, under a proper regimen, take her course, than to trust to the honesty and sagacity of the practitioner: our American practitioners are so rash and officious, the saying in the Apocrypha (38 and 15) may with much propriety be applied to them — 'He that sinneth before his Maker, let him fall into the hands of the physician!' Frequently, there is more danger from the physician than from the distemper. Our practitioners deal much in quackery and quackish medicines, as requiring no labor of thought or composition, and highly recommended in London quack bills (in which all the reading of many of our practitioners consists), inadvertently encouraged by patents for the benefit of certain fees to some offices, but to the very great damage of the subject." "In the most trifling cases they use a routine of practice. When I first arrived in New England, I asked a most noted facetious practitioner what was their general method of practice; he told me their practice was very uniform: bleeding, vomiting, blistering, purging, anodynes, etc.; if the illness continued, there was repetendi, and finally murderandi; nature was never to be consulted, or allowed to have any concern in the affair. What Sydenham well observes, is the case with our practitioners: Æger nimia medici diligentia ad plures migrat."

During this epidemic, 5,759 persons, — more than half the inhabitants, — had the disease in the natural way, of whom 844 died. Two hundred and forty-seven were inoculated by Dr. Boylston, and thirty-nine by other physicians, of whom six only died. This was one death in seven of those not inoculated, and one in forty-seven of those inoculated, showing decidedly the advantages of inoculation.

1735. On the 20th of May, in this year, scarlatina, or putrid sore throat, appeared in Kingston, New Hampshire, and became one of the most dreadful epidemics which have ever desolated New England. The first person seized was a child, which died in three days. In a week, three other children, in a family four miles distant, were taken, and died on the third day afterwards. Of the first forty, none recovered. In August, it appeared in Exeter, and soon after spread into other places. In fourteen towns in New Hampshire, 984, — chiefly persons under twenty years of age, — died, between June, 1735, and July, 1736. Of those taken sick, in some places one in three, in others one in four, and in scarcely any less than one in six, died.

In Boston, the first case occurred on the 20th of August. Subsequently the disease spread through the town. Dr. Douglass says, in the eight previous years of medium health, about 263 persons in Boston, on the average, died in seven and a half months, — October to May 18; but in this year, 382, or 114 above the usual number, died. About 4,000, or one-quarter of the inhabitants, had the disease, of whom one in thirty-five died.

In Newbury, it began in September, and, before February, 81 persons died. Thomas Smith lost two children; John Boynton four, — all buried in one grave, — two on Saturday, and two on Sunday. Benjamin Knight had three buried in one grave. In Byfield, between October, 1735, and October, 1736, 104 died; supposed to have been about one-seventh of the population. Thirteen families buried all their children. In one family eight died; four of them were buried at one time, in the same grave. In Rowley, 190 died; "probably about one-eighth of the whole town." In 1736, in Andover, 35 died; 31 in 1737, and 123 in 1738; mostly children and young people. "Capt. James Ste-

vens, his wife, and three children, died within a month. Nine families lost three children from each in a few days. Four families lost four children from each in less than fourteen days. John Wilson lost eight children in seven days. In 1739, fourteen children died in four families in a few days. Ebenezer Lovejoy lost three children in one day, and another in five days after. Joshua Stevens lost three children in four days. The disease raged most from August to December." In Haverhill, 199 died, from November, 1735, to October, 1737. What is here exhibited was to be seen in very many other towns in the state. It was indeed the " plague among children." [1]

1740–44 was a sickly period. Scarlatina prevailed in Massachusetts. In 1742 a destructive fever prevailed in Holliston. Rev. Mr. Stone, the minister, and fourteen of his congregation, died. In 1753, fourteen perished also, by a fever, in that town.

From 1745 to 1749, several sickly seasons occurred; but we have seen no definite account of them, which would exhibit their extent.

1752. Smallpox in Boston: 7,669 cases occurred, — 5,545 in the natural way, and 2,124 by inoculation, — in a population of 15,684, of whom 569 died.

1755. An alarming fever appeared in Pepperell, and spread to some of the neighboring towns, during this and the three subsequent years. From its origin and great mortality, it acquired the popular name of the Pepperell Fever. Physicians called it a " putrid malignant nervous fever "; probably the same as a severe form of the typhus. One hundred and eighty persons were sick, from August 5 to the last of October, 1756, of whom eighteen died. September 16 was kept as a day of fasting and prayer; and December 13 as a day of thanksgiving, when the sickness seemed entirely removed. Two hundred and nineteen persons were sick, from July 1 to October 15, 1757, of whom twenty-five died, — seventeen heads of families. Ninety-six persons were sick, from

[1] See Douglass' History of the Epidemic. This tract was republished in the New England Journal of Medicine, Vol. XIV, for 1825, pp. 1–13. See also Coffin's History of Newbury, pp. 204, 205; Gage's History of Rowley, p. 432; Abbot's History of Andover, p. 182; New Hampshire Historical Collection, Vol. V, p. 20; Webster's History of Epidemics, Vol. I, p. 233; Rev. Messrs. Fitch and Brown's account.

August 1 to October 15, 1758, of whom eleven died, — of which number, seven were heads of families. The population of the town was then about seven hundred. January 3, 1760, was set apart, by Rev. Mr. Emerson and his people, as a day of thanksgiving, " to commemorate the goodness of God to them the past year, especially in the removal of sickness, and the return of so many soldiers from the army." The sermon preached on the occasion was printed. " In the four years," says Mr. Emerson, " there were above 540 persons sick; 103 died, of whom 16 were soldiers from home, or just after their return; no less than 48 heads of familes; 64 grown persons. How great was our distress for two years, especially in the height of the sickness, and we, notwithstanding, obliged to find our quota for the war! I know not that we were eased more than a single man, excepting the time of the general alarm, when Fort William Henry was besieged, in 1757, when our proportion was above twenty men, at which time there were not so many able to bear arms in the place, besides those who were necessarily taken up in attending on the sick in their own families, the field officers were so good as not to call for any. One of the years, there were near two hundred confined at the same time. Your pastor at the point of death, and then confined from the house of God for four months. And of this large number who have been sick, I know not of ten persons who have been visited by the same distemper twice. Nor should we forget the bounty we received by order of authority, namely, fifty pounds, to be distributed amongst the greatest sufferers." The cause of this Pepperell fever was thought to be the miasma arising from decayed vegetable matter. The swamp or meadow of John Shattuck, near Henry Jewett's, had been overgrown with bushes and various vegetables; and, in order to kill them, and bring the land into a state of cultivation, a dam was built, and the swamp overflowed with water. When the water had been drawn off, and the vegetable matter exposed to a summer's sun, the stench was very offensive, and extended perceptibly for several miles around. [1]

[1] Butler's History of Groton, p. 350. See also Holmes's Prize Dissertation, p. 113.

1763. "In August, the Indians on Nantucket were attacked by a bilious plague; and, between that time and the February following, their number was reduced from 358 to 136. Of 258 who were affected, 36 only recovered." The Indians on Martha's Vineyard suffered from the same fever. Not a family escaped. Of 52 attacked, 39 died. It was confined in both places to the Indians, and none but those of full-blood died![1]

1764–80. During this period there were many years of sickness, but we have few facts preserved to show its extent. Throat distemper and smallpox prevailed in 1764. In Salem, 44 died of the dysentery, in 1769; 56 of fever, in 1771; 51 of dysentery, 29 of fever, and 17 of smallpox, in 1773. Dysentery was very prevalent in 1775, in various places. In Concord about 40 died. In the Andover South Parish about 200 were sick, and 56 died. Smallpox occurred in 1777–78, in Boston, and many of the country towns. Rowley "established a smoke house, in which they required all persons and baggage from Boston to take a smoking."

In 1780 a malignant typhus appeared in Boston, having been introduced by the *Alliance* frigate. Many were sick, and several died.

1792. This was the memorable smallpox year in Massachusetts. On its appearance in Boston, the inhabitants were greatly alarmed. "The whole town was inoculated in the course of three days, owing to the infatuation of the inhabitants with respect to the danger of infection, founded on a preposterous notion that so soon as any person had been inoculated the whole neighborhood was endangered. Those whose circumstances admitted had generally sent their children to the neighboring hospitals for inoculation. Those which remained were, therefore, generally in low circumstances. Whole families were often crowded together in single rooms, where fires were constantly kept up for the purposes of cooking, and the patients were destitute of most of the comforts of life, with very little personal attendance, from the disproportion of nurses to the numbers of the sick.

[1] Webster, Vol. I, p. 252.

"The consequences which ensued constituted a scene of confusion and wretchedness which no one, who was a witness of it, could have viewed without horror and commiseration. It is to be hoped, for the cause of humanity, that the inhabitants of Boston will never again experience this calamity; as they have it now in their power, by embracing the means which heaven has put into their hands in the vaccine inoculation, to secure themselves forever from its desolating ravages." [1]

Two hundred and thirty-two took the disease in the natural way, of whom 33 died; and 8,114 by inoculation, of whom 165 died. The population of the town was then 19,484. Of these, 10,655 had previously had the disease, 262 removed out of town, and 221 only, who remained, liable to the disease, escaped. The following table exhibits the cases by smallpox at the different times of its appearance in Boston:

Year	Cases	Deaths	Ratio per 100 of the population		Natural			Inoculated		
			Sick	Died	Cases	Deaths	Ratio per cent	Cases	Deaths	Ratio per cent
1721	6006	850	54.6	7.7	5759	844	14.8	247	6	2.4
1730	4000	500	26.6	3.3	3600	488	13.5	400	12	3.0
1752	7669	569	48.9	3.6	5545	539	9.7	2124	30	1.7
1764	5646	170	36.4	1.1	669	124	18.5	4977	46	.9
1776	5292	57	44.1	1.0	304	29	9.5	4988	18	.5
1778	2243	61	16.6	.4	122	42	34.4	2121	29	.9
1792	8346	198	46.0	1.0	232	33	14.2	8114	165	1.8

In Charlestown, in September and October, 1,352 were inoculated, of whom nine died. Twelve took the disease the natural way, of whom three died. Eight hundred and seventy-nine were inhabitants; the others belonged to the neighboring towns, and came in to be inoculated.[2]

In Concord, a hospital was fitted up, where 130 persons were inoculated. Some took the disease in the natural way. Ten died, two had the disease by inoculation, and eight by contagion, and they were all buried in a separate burial ground.[3]

[1] Communications, Massachusetts Medical Society, Vol. II, p. 482.

[2] Medical Repository, Vol. II, p. 10. [3] Shattuck's History of Concord, p. 224.

In Framingham, it appeared in this and the next year. Mr. Barry, in his valuable history of that town, says: "In September, 1792, according to the records, 'it having been proposed by the physicians of the town to receive permission to inoculate with the smallpox,' the town voted 'not to have the smallpox in town, by inoculation, nor any other way, if it can be prevented.' May, 1793: 'Voted, that the selectmen be a committee to prosecute any person that shall spread the smallpox, by inoculation, or any other way.' At the same time, the town granted £30 to assist the sick, and appointed a committee of distribution. A hospital was provided at the house of Mr. George Pratt. The disease was introduced into the town by one David Butler, who came to Framingham from Peterborough, and falling sick with the disease, his nurses, to the number of seventeen, took the infection, and five persons besides Butler died."

In Scituate, a smallpox hospital was opened, but it did not restrain the disease. Twelve died, in different parts of the town. "An action was commenced against the physicians, for a breach of bond for faithful discharge of duty, etc.; but after the panic which had seized the people was a little calmed, the action was withdrawn." [1]

1796. This was a very sickly year. In Boston, a very malignant typhus appeared on the 25th of August; and between that time and December many were sick, and thirty died. It created great alarm; some were buried in the night. Dr. John Warren, who wrote an account of it, says that the physicians were unanimous in the opinion that it originated from local causes.[2] "A very great portion of those taken sick were situated near extensive flats, particularly about the easterly, southeasterly, and westerly skirts of the town. The place called Oliver's Dock, where the disease was most prevalent, was exposed to exhalations from foul substances lodged about the wharves and docks of that quarter, with buildings so constructed as to admit of but very imperfect ventilation, and with large numbers of inhabitants crowded together in a small space." The following prophetic

[1] Deane's History of Scituate, p. 113.

[2] Communications, Massachusetts Medical Society, Vol. II, p. 445.

language proves that the writer then well understood the causes of disease, which have been, in recent years, brought so fully before the public: "That it originated from noxious substances, exhaled into the atmosphere from putrifying animal or vegetable matter, or both, is extremely probable, from the places in which it was most prevalent; and that a confined situation, or filthy state of the streets, alleys, and by-places of the town, will, as it becomes more populous, rents higher, and consequently the poor more closely crowded together, further expose us to the danger of such diseases, is a serious truth, which may, perhaps, in some future day, be too fatally evinced." [1]

1798. The yellow fever appeared in Boston, June 17, in a family living on Stoddard's wharf. Of eight persons in the family, five had the disease, of whom two died. It spread to Long Wharf, and in July to Fort Hill. On the southeast and south side of the hill, scarcely a family who resided below the summit escaped; one family lost five out of six. And probably the greatest part of the inhabitants in that part of the town would have fallen victims to the disease, if they had not removed into the country. In August, September, and October, it spread to the northern and western parts of the town. The number sick was not ascertained. Dr. Rand, who wrote a particular account of the epidemic, says, of 103 patients he lost 11. Whether the general proportion was the same, does not appear. He conjectured that 8,000 inhabitants removed into the country. The number who died, between June 23 and October 22, was stated by Dr. Rand at 145; by Dr. Brown at 250, and he said, "I believe that 300 is not above the real amount." The disease was supposed to have been of domestic origin, and was attributed to the filthy condition of the streets and docks, and to decayed animal and vegetable matter. The *New York Medical Repository* contains several articles on the subject.[2]

In Newburyport, the yellow fever appeared in June, and between that time and the 16th of October, about forty persons died, principally on the fourth, fifth, sixth, or seventh day of the attack. It excited great alarm.[3]

[1] New York Medical Repository, Vol. I, pp. 139, 140.

[2] *Ibid.*, Vol. II, pp. 212, 333, 390, 466.

[3] *Ibid.*, Vol. I, p. 504; Coffin's History of Newbury, p. 270.

1800. The question whether overflowing lands, for mill-ponds or other purposes, generated a malaria which was unfavorable to health, was much discussed about this time, especially by the people in the westerly part of Massachusetts, and in Connecticut.

1802. The yellow fever again appeared in Boston, near the lower end of Summer street, in the vicinity of Tileston's wharf, and about Fort Hill. About fifty died, eleven of whom were in one house. The origin of the disease was not satisfactorily accounted for. Some supposed it was imported; others, "that it arose from filth, consisting of putrid animal and vegetable matter collected near the wharves, or in a cellar in the neighborhood of the place where it commenced." The latter opinion was generally entertained. No case was known of its being communicated from the sick to the attendants.[1]

1804–05. A typhus of "uncommon malignity" appeared in Boston: fifteen died of the disease.

1805–10. The spotted fever and other epidemics prevailed during this period in some parts of the state, though no very particular account has been published concerning them. In 1808, in Amherst, six cases were fatal. In one town in Worcester County, one hundred and thirty were sick and two died. Of ninety-one cases in Barre, nine were fatal. On the 19th of March, 1810, a gentleman from Petersham wrote: "The distress in this part of the country is beyond anything you can conceive. Seven men and women, and one child, were buried in Barre, this afternoon: sixty are now sick. Dr. Holmes told me that twenty physicians would not be too many for that town alone." The same disease spread in various other parts of the state.[2]

1812–14. This period witnessed the introduction of a most fatal and alarming epidemic. It first appeared among the soldiers at Greenbush, opposite Albany, in October, 1812, and about the same time in Sackett's Harbor and Burlington. It afterwards spread through Vermont, New Hampshire, and Massachusetts. Dr. Gallup estimated that 6,400 persons died of the disease in

[1] Communications, Massachusetts Medical Society, Vol. II, p. 469.

[2] *Ibid.*, p. 138; Gallup on Epidemics, pp. 53, 58.

Vermont alone, in five months, in a population of 217,913. In Boston, 60 deaths are recorded by typhus fever, in 1812 and 1813, and 81 of "pulmonic fever" in the same time, — probably by the same disease: 400 or 500 are said to have been sick. It attacked adults principally, and was generally fatal to old people. It prevailed very generally in Worcester, and many other country towns, though the records are too imperfect to afford very accurate information.[1]

1815–16. This winter, a typhus fever of peculiar malignity, similar to that of 1812–14, already noticed, and confining its attacks principally to old people, appeared in Sharon, in Norfolk County. In ten days, eighteen out of the first twenty-four cases terminated fatally. Many were afterwards sick, and many died. It spread into Mansfield, Wrentham, and other places in the southerly part of the state. In Attleborough, more than one hundred died of this disease in three months. In Rochester, fifty died. "It is stated, as a fact, that this epidemic followed the course of rivers, tracing up the Accushnet and Mattapoiset, to the great pond in Freetown, and extending but very little beyond the meetinghouse in Rochester, which has ever been one of the most healthy spots in New England, and where it is dry and sandy. Dr. Mann states, that scarce a person escaped this fever, who lived within a mile of the great pond in Sharon, where it prevailed so fatally. Six persons, of the family of Ashley, died of this fever in one house, situate near the great pond in Freetown. This singular disease seems, therefore, to choose for its location humid and swampy situations." [2]

1819. The yellow fever again appeared in Boston, and created great alarm. The first victim was Patrick Murphy, an Irish laborer, who lived at the northerly end of Purchase, near Broad Street. He died the third day after the attack, on the 30th of

[1] The works which afford some further information on this epidemic are: Gallup on Epidemics, p. 69; Mann's Medical Sketches; New England Medical Journal, Vol. II, p. 241, Vol. IV, p. 98; Lincoln's History of Worcester, p. 311; New Hampshire Journal, Vol. I, p. 23, and Vol. II, p. 199. See also, Sanitary History of Franklin County, in appendix to Report.

[2] 2 Massachusetts Historical Collection, Vol. IV, p. 303, and New England Medical Journal, Vol. V, p. 317.

June. On the 3d of July, a female died, in the family of Josiah Bradley, on Fort Hill. On the 5th, Mrs. Thayer (who kept a boarding-house in Purchase Street, nearly opposite the present stone church), her daughter and her son, were all attacked in the morning, and died before three o'clock the same day. Others died soon after. On the 1st of August, the ship *Ten Brothers* arrived, in a foul condition. Mr. Eaton (the custom-house officer) and two laborers, who boarded her, died the night after. By order of the Board of Health, the vessel was taken into the harbor and scuttled. The effluvia of the bilge water that flowed from the vessel was exceedingly offensive; and two persons who scuttled her, and some others who happened to be passing in a sail-boat, took the disease and died. The alarm now became very great, and very many of the inhabitants removed from the city.

The disease was confined principally to the southeastern declivity of Fort Hill, in the vicinity of Purchase, High, and Griffin Streets, and Gibbs' Lane. Many persons were on board the ship, after her arrival, most of whom remained in health. About twelve, however, were seized with the fever, almost all of whom died. They and a few others were sick and died in different parts of the town.

It is not certain how many were victims to this epidemic. On the town records, thirty-four deaths by this "malignant fever" are recorded, but this does not include the whole number. Patrick Murphy, according to the record, died in consequence of "drinking cold water"; and Mrs. Thayer and her family, by "diseases unknown." Probably others died of the disease, though not so entered. This was done, perhaps, to prevent alarm. The bills of mortality, for that year, state that 108 died by "typhus," and 46 by "pulmonic fever," both of which may include some cases of yellow fever. One physician informs us that he attended seventy-five cases of this disease in that year. It was at first exceedingly malignant, and soon terminated in death; but gradually it became more and more mild and manageable, and entirely ceased about the 1st of November.

The cause of the disease was never satisfactorily ascertained. Some attributed it to the *Ten Brothers;* but this could not

have been the original and principal cause, for it prevailed here a month before the arrival of that vessel. It undoubtedly arose from some local influence, which might have been aggravated by the foul condition of that ship, as it would have been by any other similar cause, combined with the peculiar condition of the atmosphere that then existed.

It is a remarkable fact, that the disease was never known to be communicated from one sick person, or from the clothing of such person, to another, notwithstanding exposure by nurses and others to the disease in the sick and the dead, except in a single instance; and concerning that there is some doubt. The poison existed in the atmosphere of the locality, and operated where the personal condition was favorable to its reception.[1]

1831–32. In Boston, 70 died of Asiatic cholera in 1832. Of scarlatina, 84 died in 1831, and 199 in 1832. Typhus was also charged with 45 deaths. The cholera excited great alarm, and caused special preparations to be made in the city for its avoidance.[2]

On the 5th of August, 1832, at the State Prison in Charlestown, 190 were taken with cholera, — 115 in the first twenty-four hours, the remainder soon after, — all of whom recovered.

For the last forty years, notwithstanding the mass of medical literature that has been published, less definite information has been obtained concerning epidemics than in the previous periods. The almost entire neglect of records, prior to the adoption of the registration system, renders it difficult to give anything approximating to an accurate view of the subject. If a careful examination were made into the history of each town, many important facts might be gathered. But it is curious and lamentable to observe, in looking over our published local histories, how little

[1] New England Medical Journal, Vol. VIII, p. 380, and Vol. IX, p. 98.

[2] The sanitary expenses of the city of Boston, for 1832, were:

For Internal Health Department,	$21,610.67
For External Health and Quarantine Establishment,	5,222.95
For Special Measures against the Cholera, about	23,600.00
Total,	$50,433.62

Boston Medical Journal, Vol. IX, p. 209.

attention has been paid to this matter. The history of the health of the people should be regarded as the most important part of history, yet it has generally been considered unworthy of notice, or, if noticed at all, merely among the incidental matters of little consequence. It is hoped that hereafter more attention will be paid to this subject by our local historians, and that our local sanitary surveyors will make it a matter of particular investigation. The rapid, imperfect review we have taken of the sanitary history of the state, — containing, as it does, brief notices of some of the prominent epidemics merely, — suggests many important considerations, which, if more fully illustrated, might convey the most important practical lessons.

In some towns, records have been made, and especially since the registration law went into operation. From these and other sources of information we find that dysentery, typhus fever, scarlatina, consumption, and other fatal diseases, are common in nearly all parts of the state. They are constant visitors. In some periods and places more so than in others, but in all so common that they have become familiar to us, and cease to excite notice or alarm. An amount of sickness, which formerly would have thrown the whole community into a state of consternation, may now occur as an ordinary event, and elicit no special attention.

To complete this general view of the sanitary condition of the state, and as further illustrations, we have compiled from the Registration Reports, from the " Bills of Mortality " of Boston, and from other sources of information, several tabular statements, which we shall now present. A general view of the influences on human life and longevity, existing in the state, is presented, which exhibits the rate of mortality among the inhabitants of Boston at three different periods; and among those of an interior town of the state, of an average health. (See tables, pages 284–285.)

This important table has been compiled with great care, and will be found to represent the law of mortality in different places in Massachusetts, more accurately than any one heretofore published. The columns relating to Boston have been carefully compiled by a comparison of the population with the deaths for nine years; four before and four after that in which the enumera-

tion was made. This admits of a fair average, and an accurate result. The column under " country towns " is compiled from a careful examination, abstract, and combination of the records of deaths in Concord and Worcester, Massachusetts, and in

STATEMENT OF THE RATE OF MORTALITY AMONG THE INHABITANTS OF BOSTON, FOR 1830, 1840, AND 1845; AND OF AN INTERIOR COUNTRY TOWN IN MASSACHUSETTS, FOR 1830

Ages	Population of Boston					Population of Country Towns
	1830	1840	1845			
	Both Sexes	Both Sexes	Males	Females	Both Sexes	Both Sexes
Under 5	8,068	11,522	7,234	7,214	14,448	1,249
5 to 10	6,106	8,956	5,690	5,668	11,358	1,036
10 to 15	5,501	7,221	4,708	4,928	9,636	963
15 to 20	6,903	8,841	5,199	5,750	10,949	1,013
20 to 30	16,182	22,960	15,009	14,586	29,595	1,791
30 to 40	9,070	12,675	10,455	9,526	19,981	1,129
40 to 50	5,019	6,707	4,991	5,038	10,029	752
50 to 60	2,569	3,561	2,142	2,618	4,760	488
60 to 70	1,316	1,640	1,062	1,406	2,468	356
70 to 80	504	673	315	578	893	241
80 to 90	140	212	73	148	221	86
Over 90	14	32	12	16	28	9
All ages	61,392	85,000	56,890	57,476	114,366	9,113
	Deaths in Boston for 9 Years					Deaths for 10 Years
Under 5	4,334	7,600	6,224	5,481	11,705	38.2
5 to 10	448	738	703	609	1,312	6.2
10 to 15	274	397	292	341	633	3.1
15 to 20	309	483	330	408	738	5.3
20 to 30	1,526	2,036	1,556	1,747	3,303	13.2
30 to 40	1,484	1,766	1,540	1,377	2,917	11.1
40 to 50	1,025	1,276	1,138	810	1,948	11.0
50 to 60	678	903	679	594	1,273	9.4
60 to 70	544	723	516	541	1,057	11.0
70 to 80	420	589	324	463	787	13.8
80 to 90	205	293	137	242	379	11.6
Over 90	41	54	28	47	75	2.1
All ages	11,288	16,858	13,467	12,660	26,127	136.0

STATEMENT OF THE RATE OF MORTALITY AMONG THE INHABITANTS OF BOSTON, FOR 1830, 1840, AND 1845; AND OF AN INTERIOR COUNTRY TOWN IN MASSACHUSETTS, FOR 1830 (continued)

ANNUAL MORTALITY PER CENT

AGES	BOSTON					Population of Country Towns
	1830	1840	1845			
	Both Sexes	Both Sexes	Males	Females	Both Sexes	Both Sexes
Under 5	5.96	7.32	9.55	8.44	9.00	3.05
5 to 10	.81	.91	1.37	1.19	1.28	.59
10 to 15	.55	.61	.68	.76	.72	.32
15 to 20	.49	.60	.70	.78	.74	.52
20 to 30	1.04	.98	1.15	1.33	1.24	.73
30 to 40	2.01	1.54	1.63	1.60	1.62	.98
40 to 50	2.24	2.11	2.53	1.78	2.15	1.46
50 to 60	2.93	2.81	3.52	2.52	2.97	1.92
60 to 70	4.58	4.89	5.39	4.27	4.75	3.08
70 to 80	9.24	9.71	11.42	8.89	9.78	5.72
80 to 90	16.21	15.33	20.82	18.10	19.04	13.48
Over 90	32.14	18.75	25.83	32.50	29.64	23.33
All ages	2.04	2.20	2.63	2.44	2.53	1.49
Living to 1 dth.	48	45	38	41	39	67

Amherst, N. H., for the ten years, 1826 to 1835, inclusive, with the abstract of the census of 1830. The records of those towns were at that time supposed to be full; and, though not the healthiest, may be considered, among the country towns, of about an average health. In many places, a comparison of the whole number of deaths with the population gives a much more favorable result, and in others not so favorable. This table deserves to be carefully studied.

The following are some of the many important conclusions to which the facts thus far disclosed lead us:

1. It is proved that there is a great difference, in this state, in the longevity of people living in different places and under different circumstances. This fact is presented in a forcible manner in the subjoined illustration, taken from the Census of Boston. The cut is drawn in ten divisions, each way; those from left to

right representing the ages of life; those from top to bottom, the percentage of survivors:

Take one hundred persons from each of four different classes of people: 100 of those who enjoy an amount of life equal to the healthy classes in England; 100 of those who died at Newton, in 1810 to 1830; 100 of those who died in Boston, in 1840 to 1845;

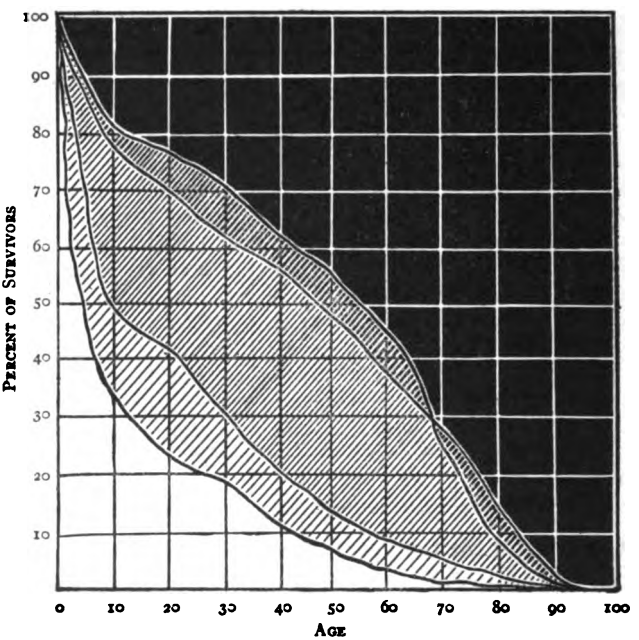


FIG. 8. Longevity under Different Conditions.

and 100 of the Catholics of Boston. If each of the hundred persons in all these classes had lived 100 years, each class would have enjoyed 10,000 years of life. But persons die at all ages, and in some classes very much earlier than in others. Accordingly four lines are drawn diagonally across the cut, from the top on the left to the bottom on the right, to represent the amount of life that each class enjoyed. The white and shaded spaces below these lines represent life, and the dark and shaded spaces above the lines represent death. The upper line represents the survivors in England; the next below, those in Newton; the third, the general

population of Boston; and the fourth, the Catholics. It will be perceived that 82 per cent, or 82 out of every 100, of the lives in England pass the line of 10 years, or survive that age; while only 34 per cent, or 34 out of every 100 Catholics, pass the same line! That 38.75 per cent, in Newton, survived 60 years, while only 9.95, in Boston, survived the same age! Other comparisons, equally striking, may be made.

2. It is proved that causes exist in Massachusetts, as in England, to produce premature and preventable deaths, and hence unnecessary and preventable sickness; and that these causes are active in all the agricultural towns, but press most heavily upon cities and populous villages.

3. It is proved that measures, — legislative, social and personal, — do not at present exist, or are not so fully applied, as they might be, by the people, for the prevention, mitigation, or removal, of the causes of disease and death.

4. It is proved that the people of this state are constantly liable to typhus, cholera, dysentery, scarlatina, smallpox, and the other great epidemics; and to consumption, and the other fatal diseases, which destroy so many of the human race in other parts of the world.

5. It is proved that the active causes of disease and death are increasing among us, and that the average duration of life is not as great now as it was forty or fifty years ago.

CHAPTER XIX

PLAN FOR A SANITARY SURVEY OF THE STATE

We now proceed to give an outline of a plan for the Sanitary Survey of the state which we propose for adoption. In drawing it up we have carefully inquired into the circumstances of many cities and towns in the state, and the sanitary condition of the inhabitants; and have, with no inconsiderable labor, matured a series of measures, which seem to us best adapted, under all the circumstances, as the plan which would be most likely to be practical and useful. In the progress of the inquiry, we have examined many printed works on the subject, and have availed ourselves of the information elicited in correspondence with gentlemen in Europe and in this country, whose knowledge, experience and judgment in these matters are entitled to the highest regard.

In a valuable communication, received from the councillors of the Massachusetts Medical Society, a preference is given to the plan of appointing a single individual to make the survey, after the manner of the agricultural, zoölogical, and other scientific surveys, which have heretofore been made by the state. Objections are, however, urged with considerable force against this plan. It is said that to intrust so great and important a work to one mind, however well qualified, would be less likely to receive public confidence and approbation, and hence would be less useful, than if it were the joint production of several minds, or received their joint approval; that if made with the facts at present accessible, although it would afford much valuable information, it might lead to erroneous conclusions; and that it would be merely transient, and not of permanent usefulness.

The English sanitary surveys have generally been the results of the joint labors of several individuals; and nearly all of them, of authority and usefulness, have been based principally upon the facts furnished by the efficient system of registration of births, marriages, and deaths, in operation there. Those which have de-

parted from these facts, or have made a partial selection from them, are more or less mixed up with error.

Health is a variable matter, capable of improvement or deterioration. It may be good in one year, and not in another, and not alike in two places at the same time. No plan can therefore be extensively useful, or permanently valuable, which shall be confined to a single year or a single survey. It should extend over a series of years, and through a series of successive observations and examinations. In this way only can the laws of health and life of any place be accurately ascertained, and a sanitary survey produce all the good that might be attained by it. People are prone to neglect their own and the public health, and this fact is a reason why the subject should be frequently brought to their notice.

Our plan consists of a series of measures, which may be rendered permanent if desired, presented in the form of separate recommendations. They are divided into two classes, and are to be regulated and controlled by the agencies which are proposed to be established; one by the legislative authority of the state, and the municipal authorities of towns and cities, and the other by social organization and personal action. Though intimately connected, these measures are in some respects independent of each other. They are not of equal importance, and it is not expected that they will all be immediately made use of; a part only may be adopted at one time, and another part at another time, as circumstances may require. They are here presented together, as necessary to give fullness and unity of design to the whole plan. It is not supposed, however, that they are all the useful sanitary measures which a complete and perfect plan would require. The progress of this inquiry, and the circumstances which it develops in different years, — the discoveries which will be made by the united intellectual efforts that will be brought to bear upon this subject, — will suggest others. Some of these measures are of great magnitude, and would each furnish matter for a volume, if fully explained and illustrated. All we propose to do in this connection is, to name and define each, and to give a brief explanation and illustration of its character and design. These measures, it

must be recollected, however, are only a series of plans by which a sanitary survey might be carried forward. The accompanying information is inserted merely to illustrate these plans.

I. STATE AND MUNICIPAL MEASURES RECOMMENDED.

Under this class of recommendations are to be included such measures as require, for their sanction, regulation and control, the legislative authority of the state, or the municipal authority of cities and towns. They may be called the legal measures, — the *Sanitary Police* of the state.

I. We recommend that the laws of the state relating to Public Health be thoroughly revised, and that a new and improved act be passed in their stead.

We suppose that it will be generally conceded that no plan for a sanitary survey of the state, however good or desirable, can be carried into operation, unless established by law. The legislative authority is necessary, to give it efficiency and usefulness. The efforts, both of associations and individuals, have failed in these matters. We have shown that the present health laws of the state are exceedingly imperfect, even for the general object for which they were designed; that it is difficult, and perhaps impracticable, to ascertain what precise powers they confer, and what duties they require; and that they are not adapted, in any way, to the purposes of a sanitary survey. This must be apparent to any one who may examine them.

Entertaining these views, we suggest that a general health law should be passed, which should be comprehensive in its design and simple in its provisions, — be adapted to the present circumstances of the state, and be so framed that it might be clearly understood and carried into practical operation; and which, while it would answer all the purposes of a general health act, as heretofore understood, would, at the same time, accomplish all the purposes of a sanitary survey.

We have accordingly drawn up, and present in the appendix,[1] a draft of such an act as, in our judgment, it would be expedient to pass, to secure the advantages designed to be attained. It creates

[1] See original report.

a permanent agency, for the regulation and control of all matters relating to the sanitary condition of the state and its inhabitants.

II. We recommend that a general Board of Health be established, which shall be charged with the general execution of the laws of the state, relating to the enumeration, the vital statistics, and the public health of the inhabitants.

The duties of the Board are pointed out in the fourth section of the act. They are to have the general direction of each census; to superintend the execution of the sanitary laws of the state; to examine and decide upon sanitary questions, submitted to them by public authorities; to advise the state as to the sanitary arrangements of public buildings and public institutions; to give instructions to local Boards of Health, as to their powers and duties; to suggest local sanitary rules and regulations; to recommend such measures as they may deem expedient, for the prevention of diseases and the promotion of the public health; and to report their proceedings annually to the state.

III. We recommend that the Board, as far as practicable, be composed of two physicians, one counsellor at law, one chemist or natural philosopher, one civil engineer, and two persons of other professions or occupations; all properly qualified for the office by their talents, their education, their experience, and their wisdom.

The members should not be selected exclusively from one profession, for two reasons: 1. Numerous questions, requiring a knowledge possessed by different professions, will be presented for discussion and decision; and it is desirable that the Board should be able to bring competent knowledge to the investigation of every subject. 2. To show to all that the promotion of public health is a matter which does not belong exclusively to the medical profession, but concerns every profession and every person. The idea which too generally prevails, that everything relating to health belongs exclusively to one profession, operates against sanitary improvement. The services of medical men are indispensable; but the services of other professions, and of every person in their respective spheres, must be put in requisition, before reform can be complete. The Board should therefore contain —

1. Two physicians, at least, of scientific attainments, and of extensive practical experience in their profession, thoroughly understanding sanitary science, and deeply feeling the importance of wise sanitary measures.

2. One counsellor at law, who, besides the general knowledge of law and medical jurisprudence which he could bring to the purposes of the Board, might especially be able to investigate any legal question that might arise.

3. One chemist, or natural philosopher. Many questions relating to the influence of the elements on the production or prevention of disease may require the special investigation of an experienced chemical philosopher, and this important branch of science should be ably represented at the Board.

4. One civil engineer, possessing competent knowledge to determine the best methods of planning and constructing public works, and the best architectural sanitary arrangements of public buildings, workshops, and private dwelling-houses, would be an exceedingly valuable member.

5. Two other persons, of acknowledged intelligence, good judgment, and of practical experience in the common business affairs of life, and capable of investigating and fully understanding the principles of sanitary science, might compose the remainder.

All should make themselves thorough masters of the objects of their appointment; have sagacity and foresight to perceive the bearing and effect of every measure proposed; be eminently practical men, wise in deliberation, and judicious in decision.

IV. We recommend that the Board be authorized to appoint some suitable and competent person to be the Secretary of the Board, who should be required to devote his whole time and energies to the discharge of the duties of his office, and be paid a proper salary for his services.

V. We recommend that a local Board of Health be appointed in every city and town, who shall be charged with the particular execution of the laws of the state, and the municipal ordinances and regulations, relating to public health, within their respective jurisdictions.

VI. We recommend that each local Board of Health appoint a Secretary; and also, if occasion require, a Surveyor and Health Officer.

VII. We recommend that local Boards of Health endeavor to ascertain, with as much exactness as possible, the circumstances of the cities and towns, and of the inhabitants under their jurisdictions; and that they issue such local sanitary orders and make such regulations as are best adapted to these circumstances.

VIII. We recommend that local Boards of Health endeavor to carry into effect all their orders and regulations in a conciliatory manner; and that they resort to compulsory process only when the public good requires it.

IX. We recommend that an appropriation be made annually by the state, for the purchase of books for the use of the general Board of Health; and by each city and town for the purchase of books for the use of each local Board of Health.

X. We recommend that each local Board of Health be required to make a written report annually to the town, concerning its sanitary condition during the next preceding year; and to transmit a written or printed copy of the same to the general Board of Health.

XI. We recommend that the sanitary and other reports and statements of the affairs of cities and towns which may be printed should be in octavo form, on paper and page of uniform size (similar to the public documents of the state), and designed to be bound together, as the *Annual Reports of the Town;* and that five copies be preserved by the Board of Health, one copy be furnished to the general Board of Health, one to the State Library, and that others be given to Boards of Health elsewhere in exchange for their publications.

XII. We recommend that the successive enumerations of the inhabitants of the state be so made, abstracted, and published, that the most useful and desirable information concerning the population may be ascertained.

Several important purposes are attained in an accurate enumeration or census of the inhabitants. The constitution of the United States and of this state both require such enumerations

to be made, as the basis on which the number of representatives to the national and state legislatures shall be determined. This is a political purpose. The character of man, as a social being, is modified by the circumstances of his existence, and varies as these circumstances vary in their development in different places and at different periods; and it is desirable for a social and scientific purpose that such characteristics may be ascertained as will exhibit these varieties or differences. An exact knowledge, too, of the living inhabitants in a given locality, is the first, and an essential element, for estimating their sanitary condition. This is the third most important purpose.

What then are the characteristics of a population, which it is desirable and important should be known, and which admit of positive ascertainment? In our judgment, the following classes of facts are desirable in every census: [1]

1. Color and freedom. Three classes of persons exist in this country, — the whites, the colored, and the Indians; and of the colored there are two sub-classes — the free and the slave. The political rights, possessed by each of these classes, differ in different states; and it has been supposed that they are not all affected alike by the same sanitary influences. The numbers possessing each of these characteristics should therefore be ascertained both for political and sanitary purposes.

[1] The purposes of this report will not admit of so full an explanation and illustration of these several classes of facts, nor of the plan of obtaining them and of making the abstracts for publication, as may be necessary to make them clearly understood. Those who desire further information on the subject are referred to a Report on the State Census of Massachusetts (House document No. 127, for 1849); to the Instructions issued for taking the seventh census of the United States; to the Report on the Census and Statistics of Boston for 1845; to an article in the Journal of the Statistical Society of London, on the Best Mode of taking the Census of the United Kingdom for 1841, Vol. III, p. 72, for April, 1840; to the three volumes of Abstracts of that Census, published under the titles of the Enumeration Abstract, Occupation Abstract, and Age Abstract; to the admirable but voluminous Report of the Commissioners for taking the Census of Ireland for 1841; to the series of Reports of the Registrar General of births, deaths and marriages in England, and especially to the Appendices to the Ninth Annual Report, and to the "Recensement Général" — the General Census of Belgium for 1846 — a work admirably executed, under the Central Statistical Commission, of which M. Quetelet is President. These works contain the results of the more recent experience, and should be carefully studied by all who may have the superintendence of the census.

2. Sex is another characteristic universally acknowledged as important, and the number of each should be carefully obtained.

3. The ages of the population are characteristics, interesting and important in many respects, and indispensably necessary in all sanitary inquiries. Without them a census is comparatively useless. They should be ascertained by the enumerator with as much exactness as possible; and afterwards so abstracted that uniform comparisons may be made between the populations of the same ages living in different places, at different periods, and under different circumstances; and with the dead.

4. The domestic condition, or the number of unmarried, married, and widowed, is an interesting characteristic, which has been ascertained in the censuses made by nearly all the governments of Europe, and should be known for its important social and sanitary influence.

5. The occupations of the people have an influence upon their character and health. The facts should be obtained, at least, in relation to all males over fifteen years of age, and engaged in the principal professions and occupations.

6. The place of birth should be known, so far as to specify separately those born in the town or city where they reside (to show the sanitary influence of locality), those born in the different states of the United States, and those born without the United States.

7. Education has an influence upon the sanitary condition of the people; and some facts regarding it should be known concerning all persons over twenty years of age. An answer to the question, "Can you read and write?" — will afford a simple and definite fact, and may be obtained concerning every person.

8. House accommodation is quite important. The number of persons to a family, and the number of families and persons to a house, and the extent of their accommodations, should be known. Life and health are often affected by overcrowded dwellings.

9. Means of subsistence and comfort also have an influence upon the sanitary condition of a people. A simple but definite, certain and important fact, as to this characteristic, might be determined by the number of "owners of real estate" (not "the

value of real estate owned," which is indefinite and uncertain as applied to individual inquiry). A comparison of the proportion of this number or class of persons, with the whole population of different places and at different periods, would exhibit interesting results.

10. Health. Useful information concerning four special diseases, — blindness, deafness, insanity and idiocy, — has been ascertained in the last two censuses. The number of persons thus afflicted, as well as the number of paupers and criminals, should be known.

Two plans have been devised for obtaining the facts in a census.

1. By abstract inquiry; and by the use of a blank tabular form of a schedule, containing headings, under which are to be entered the different classes of facts, and in such form, as they are intended to appear in the final printed abstract. They are elicited by the inquiry, — How many are in this class, and in this, and so on, naming each class. It is obvious that even by this plan, if accuracy is intended, the characteristics of every person and of every elementary fact, so far as relates to all the particulars required by the schedule, must first be obtained separately; and afterwards, though at the same time, they must be analyzed, abstracted and combined, and entered under the respective heads to which they belong. By this complication of the matter errors are likely to occur, and cannot easily be avoided. This plan may answer for guesses, or estimates, but affords no check against over-estimates or imperfections, nor is it any test of accuracy; and besides, such a plan admits of no other combination or abstract of the facts than the one pointed out in the schedule.

2. By individual or elementary inquiry; and by the use of a blank schedule, in which the name of every person enumerated is to be entered; and opposite the name, under separate headings, such facts, descriptive or characteristic of each, as are designed to be ascertained. These may be more or less extended at pleasure. By this plan, the single object of obtaining the elementary facts of the census, in the most simple, correct and positive manner, without complicating the labor at the time with any combination or abstract, is all that is attempted by the enumerator. The

abstracts for publication are made in a different form by another agency. It is obvious that by this plan errors will be much less likely to occur, and may be more easily corrected at the time if they should happen, than by the plan of abstract inquiry. Taking the name of every person will be a guarantee that no more will be returned than actually exist. And the same facts may be accurately obtained, more easily, rapidly, and economically. And besides, the facts thus obtained may be abstracted and combined in very many different ways, to show a much greater variety of interesting and important results.

The first is the plan hitherto adopted in the censuses of the United States. The second, however, is now regarded by all correct statists, who have carefully examined the two plans, as very much the best, and as the only one which will ensure accuracy. It was first introduced into this country[1] in the census of Boston, in 1845; and, since then, that example has been commended and followed by other cities. A modification of the plan, designed for general application, was prepared at the special request of the Census Board at Washington, and has been adopted, though not without some deviations, for the seventh census of the United States, to be taken this year.[2]

The schedule recommended, relating to the free inhabitants, contained the following headings:

Dwelling-houses, numbered in the order of visitation	Families, numbered in the order of visitation	Name of every person whose usual place of abode, on the first day of July, 1850, was in this family	Description			Domestic condition		Profession, occupation, or trade, of each male person over fifteen years of age	Owners of real estate	Place of birth		At school during last year	Persons over twenty years of age who cannot read and write	Whether deaf and dumb, blind, insane, idiotic, a pauper, or a convict
			Age	Sex	Color, White, black, or mulatto	Married	Widowed			Born in the town, where each resides	In what other states, territories or countries born			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

[1] By Lemuel Shattuck. — Ed.

[2] The design of the schedule should be to obtain some positive, existing, known

These schedules are designed to contain complete registers of the population. Three sets, or copies, are to be made; one of which is to be deposited in the office of the court of the county, and one in the office of the secretary of the state, to which they relate; and the other is to be forwarded to the Secretary of the Interior, at Washington. Under his superintendence, or that of some person whom he shall appoint, these schedules are to be arranged. They are not to be published, nor are they to be considered as models for publication; but they are to serve the simple purpose of containing a comprehensive mass of useful elementary facts concerning the people. These facts are to be classified, abstracted, and published, in such form, to such extent, and with such deductions, as shall be deemed useful and proper. An excellent plan for the abstracts, as to the ages, for general or sanitary purposes, is furnished in the example taken from the English census. The ages of the population of every county in the United States, and of every town in this state, should be abstracted in this way. Every census should be made under the superintendence of intelligent, competent persons, familiar with statistical science, and especially with that part of it which relates to human life, — its reproduction, its continuance, and its extinction. The value of the results will greatly depend upon the degree of intelligence applied to their production. The plan we recommend is not an exception to this general rule. Like others, it must have intelligence to carry it into successful execution; but, if so executed, it will secure a far more complete and perfect census than any hitherto taken. A competent central commission, at Washington, with power to appoint subordinate commissions in each state, has heretofore been recommended for the national census. For our state enumerations, we have proposed that they shall be made under the direction of the general Board of Health. The plan above recommended might be fully carried out by them, and as complete and as accurate a State Census as can be desired might thus be obtained. The same agency that abstracts and publishes information concerning the dead should make and pub-

characteristics of the population, at the time of the enumeration. Whether "married within the year" is an historical inquiry, and the "value of real estate owned" a collateral one, which destroys the unity of the design.

lish information concerning the living. The abstracts should be made on a uniform plan, so as to be easily compared together.

Every local Board of Health should have, for their own use, a manuscript Register of the Population of their own city or town, as proposed, with an index for reference to each family. It would be of great service in the various sanitary matters which might come before them.

Enumerations of parts of the population, for a special purpose, are often made. The number of children between certain ages is required to be known every year, as a basis for the division of the income of school funds, in different states. In a letter contained in the appendix to the fourth *Registration Report*, the writer said: "The educational age, as fixed by the laws of Massachusetts, is 4 to 16. It seems to me, however, that this specific classification is injudicious, and that 5 to 15 would be better. The latter points or ages are universally adopted by nations, as important in the divisions of the population, and in the statistics of the dead; and there are many reasons why the educational age should be within these points. It would be less labor to make the enumeration; and, from examinations which have been made, it appears that the ages of children attending school more nearly correspond to them. Comparisons could be more readily made with the ordinary divisions of the population. I agree in opinion with a recent eminent writer, in thinking, in its application to schools, that 'hereafter 15 will be the age at which, in any census, it will be considered that, in the mass of the community, occupation begins, and education ends.'" In 1849, this hint was matured into a law; and 5 to 15 is now the legal educational age in Massachusetts.

XIII. We recommend that the Constitution of the state be so altered, that the State Census shall be taken in 1855, and at the end of every subsequent period of ten years.

XIV. We recommend that the laws relating to the public registration of births, marriages, and deaths be perfected and carried into effect in every city and town of the state.

A new act relating to registration was passed on the 3d of May, 1849, and instructions have been prepared for carrying it into

effect, and issued by the Secretary of State. The law is becoming more and more popular; and, if superintended by an efficient state agency, and faithfully carried into operation by the local authorities of all the towns, it may secure the many important benefits designed by its passage.

Death affects the human race nearly according to a uniform law, modified in its operation only by exchange of circumstances; but it does not affect different ages alike, even if all other circumstances are the same. At some ages persons are much more liable to death than at others. Some, however, suppose that, in a school composed of youth, or in a manufactory composed of operatives of more advanced life, or in a prison or in the army, filled with persons in middle life, if the living to one death, or the average age at death, are the same as the whole population of the town or place where located, then their health would be the same; and if it differed, it would indicate a different degree of health. But it is not so. These are select lives, and they are governed by the laws of their age only, and not by those applicable to the whole population of the town, composed of persons of all ages. This matter is so little understood, and so many mistakes are made, even by eminent statists, that it should be clearly illustrated.

On returning to the table already given, the law of mortality is given for the whole of England, and for Surrey, one of the most healthy, and for Liverpool, one of the most unhealthy districts of England. Now let us suppose the existence of three communities, A, B, and C, each containing 1,000 persons, but differently constituted as to ages. In A there are 200 families, containing 100 persons between the ages of 30 and 40 years, 300 between the ages of 20 and 30; and each of these families contain, on the average, 3 children under 5 years of age. In B there are several boarding schools, in the families connected with which there are 100 persons between 20 and 30 years, 300 scholars and other persons between 15 and 20, and 600 between 10 and 15. And in C, composed principally of elderly persons, there are 100 persons between 40 and 50 years, 300 between 50 and 60, 400 between 60 and 70, 150 between 70 and 80, and 50 between 80 and 90. And let us suppose that each of these communities have been

subjected to the same sanitary laws, alternately, as the most healthy and the most unhealthy districts of England, as given in the table already referred to, and the result would be as in the following table:

Ages	Suppose the number and ages of the whole population in each of three different communities, — A, B and C, — are as follows:			Subject these several populations, alternately, to the same rates of mortality in different localities, the number who would die					
				In a healthy locality, would be			In an unhealthy locality, would be		
	In A	In B	In C	In A	In B	In C	In A	In B	In C
Under 5	600	...	...	24.73	...	...	86.23	...	...
5 to 10	...	...	...	...	...	...	...	...	...
10 to 15	...	600	...	...	1.90	...	...	3.78	...
15 to 20	...	300	...	...	1.86	...	...	2.96	...
20 to 30	300	100	...	1.90	.63	...	3.80	1.26	...
30 to 40	100	...	...	1.00	...	...	2.16	...	...
40 to 50	...	...	100	...	...	1.17	...	...	3.36
50 to 60	...	...	300	...	...	6.85	...	...	15.91
60 to 70	...	...	400	...	...	25.43	...	...	42.53
70 to 80	...	...	150	...	...	23.01	...	...	31.11
80 to 90	...	...	50	...	...	21.42	...	...	16.11
Total.....	1000	1000	1000	27.63	4.39	77.88	92.19	8.00	109.02
Deaths in 100 living, or per cent,				2.76	.43	7.78	9.22	.80	10.90
Or to the whole living, one in				36.19	232.55	12.84	10.84	125.00	9.17
The average age of each was				5.22	16.41	73.55	4.17	16.28	68.73

It appears from this table that in these three communities, under healthy circumstances, alike in all respects excepting age, the deaths were 27.63 persons, or 2.76 per cent, in A; 4.39 persons, or .43, or less than ½ of 1 per cent, in B; and 77.88 persons, or 7.78 per cent, in C; that there were living to 1 death, 36.19 persons in A; 232.55 persons in B; 12.84 persons in C; and that the average ages at death of those who died were, 5.22 years in A, 16.41 years in B, and 73.55 years in C! And under unhealthy circumstances the facts as strikingly appear.

It may perhaps be said, that communities so constituted have never existed. They have not, exactly in this relation, but they may and actually do exist in some degree approximating to it. If so, nothing need further be given to illustrate the incorrectness

and even absurdity of using the average age at death, or the number of a population out of which one may die annually, alone, as accurate standards for sanitary comparisons. And it follows, also, that it is necessary, not only to know the number of the living at each age, but how much life is created and produced, or how many persons are born, on which the laws of mortality operate. By this knowledge alone we might estimate the number of deaths, and the average age at death, with considerable exactness.

The following principles may be considered as settled; though we have not space in this connection to illustrate them fully. They should govern all those who make sanitary surveys of different places or populations.

1. That a uniform law of mortality exists, which destroys more persons at one age than at another, in all other circumstances exactly similar; and that this law is modified in its operation in a healthy and in an unhealthy locality, only by its being less stringently regarded in the one than in the other.

2. That the generative power and ability to produce a healthy race is mainly ascertained by the number of marriages, the age at marriage, and the number of married persons living in the procreative ages, combined with other personal circumstances; and hence arises the sanitary importance of ascertaining in a census, as a characteristic of the population, the number of the married at different ages, and of recording each marriage and the age at marriage.

3. That when the number of births is great, the number of deaths is proportionally great, and the average age at death proportionally low; and that an excessive production of life is one of the causes, not consequences, of great mortality; and hence the number of births is a necessary element in estimating the sanitary condition of a population.

4. That the average age at death, as well as the aggregate number of a population out of the whole of which one dies annually, though interesting as a characteristic of the population, is a fallacious test of its sanitary condition; and cannot be employed alone, for that purpose, without leading to serious errors.

It can be applied, as an accurate test, only when the ages of the living inhabitants compared are alike.

5. That selecting a class of the population, such as the professional men, the tradesmen, the laborers, the rich, or the poor, and giving their average age, or the average number of years of life that either live less than the others, or that either lose more than the others, as a test of the sanitary condition of the class, may mislead the inquirer, and cannot be relied upon as an accurate test.

6. That the information concerning the rate of mortality supposed to have prevailed in past ages, when the calculations have been made upon the erroneous basis mentioned in the last two conclusions, cannot be taken as an exact test for comparison with the present age, without some allowance of error. Few observations concerning the living or the dead were made with accuracy in the olden times.

7. That the only accurate tests of measurement for one place are those founded on a joint comparison of the number of persons living at each age, with the number of deaths at the same age; or for different places, a comparison of the same facts regarding the population of the same ages in both places; or the same population, in two places, supposing it to be removed from the one place to the other.

8. That in estimating the effects of immigration and emigration on the sanitary condition of a population, the difference both between the ages of those who come in and those who go out, and the ages of the permanent population, must always be considered. Other circumstances being equal, a difference in this respect will produce a different rate of the whole mortality.

9. The same joint comparison should be made separately of the ages of the living and the ages at death of all who die, by each disease; in each season of the year; of each sex; of each occupation; and of those characterized by other circumstances. The number, as influenced by either of these circumstances, will be increased or diminished in proportion as more or less are found of one age more than of another. For this purpose a variety of tables might be constructed to exhibit the facts in a condensed form.

10. That an accurate enumeration of the number, ages, etc., of living persons, and an accurate public registration of every birth, every marriage, and every death, with all the information desired relating to each, are absolutely essential as the foundation of every estimation of the sanitary condition of a population; and a sanitary survey, where this is wanting, can be of little value.

11. That for all practical purposes, as means of comparison, the living and the dead may be divided as to the ages, into decennial periods, or periods of ten years each, for those over twenty; into quinquennial periods, or periods of five years each, for those under twenty, and into each year of life for those under five years. This admirable division has been adopted in England. For special purposes three divisions should be made,—of those under 15, of those between 15 and 60, and of those over 60,— as the Dependent, the Productive and the Aged classes. The division, sometimes made between those under 20, and over 20, as "boys and girls," and "men and women"; or as "children and adults," is indefinite, unmeaning, and useless; as are also the ages 4, 8, 14, 16, 21, and 45, which have been sometimes used as dividing points.

12. That to secure such uniformity at different places and at different times, in the abstracts of the facts concerning the living inhabitants, and the dead, that each may be accurately compared together, both should be made under the superintendence of one agency, and that agency should be the general Board of Health.

XV. We recommend that provision be made for obtaining observations of the atmospheric phenomena, on a systematic and uniform plan, at different stations in the Commonwealth.

XVI. We recommend that, as far as practicable, there be used in all sanitary investigations and regulations, a uniform nomenclature for the causes of death, and for the causes of disease.

As in the nomenclature and classification of causes of death it has been found difficult to make one which shall be universally approved, so in classifying the causes of disease the same difficulty may occur. Yet we deem it proper to recommend that all causes of disease should be divided into three general classes: 1. Atmospheric; 2. Local; and 3. Personal.

I. Under Atmospheric Causes, we would include those to which all persons in a country or district, in circumstances in all respects alike, are equally exposed. Sub-classes: 1. Climate; 2. Seasons; 3. Winds and weather; 4. Electricity; 5. Atmospheric weight, temperature, moisture, and composition; 6. Malaria; 7. Unknown conditions of the atmosphere. What have been called epidemic causes of disease come under these classes.

II. Under Local Causes we would include those to which persons living in a particular neighborhood or dwelling-house, in circumstances in all respects alike, are equally exposed. Sub-classes: 1. Elevation or depression of situation; 2. Deficiency or impurity of water; 3. Defective sewerage, drainage, and surface cleansing; 4. Animal and vegetable effluvia; 5. Confined and corrupted air; 6. Irregular and imperfect supply of light and heat; 7. Filthy or damp habitations; 8. Existing contagious diseases; 9. Unknown local causes. What have been called endemic causes of diseases come under these classes. We would, however, restrict them to a particular house, street, or neighborhood. When the influence spreads over a whole town or district, it becomes an atmospheric cause.

III. Under Personal Causes we would include those which originate with the person alone, independent of atmospheric or local causes. Sub-classes: 1. Hereditary constitution, organization or vitality; 2. Acquired constitution, organization or vitality; 3. Deficiency and excess in quantity, and improper kind of food; 4. Improper quantity and kind of clothing; 5. Occupations and habits; 6. Excessive physical exertion; 7. Excessive mental action; 8. Alienation of mind; 9. Exposure; 10. Personal contact with a diseased person, virus or poison; 11. Violence and accidents; 12. Unknown personal causes.

Atmospheric, local, and personal contagion may exist as causes of disease. Some diseases can be communicated only by actual contact with another person, or with the poison of the disease of the person; as itch, syphilis, necusia, etc. This is personal contagion. Others may be communicated either by contact with the air of the locality where the diseased person is or has been; as smallpox, measles, etc.; or with the poisonous

emanations from decomposing animal or vegetable matters, or from other substances; this is local contagion. Others may be communicated by contact with the atmosphere while in a peculiar condition; as influenza, dysentery, cholera, etc.; this is atmospheric contagion. All these kinds of contagion may exist, to a greater or less extent, and press upon us with greater or less power.

Atmospheric contagion is generally harmless unless attracted by local causes; and if atmospheric and local contagion be combined, it may be successfully resisted by a person fortified with sufficient personal vitality. There seems to be a chemical affinity between the epidemic constitution of the atmosphere, and filth and unfavorable local circumstances, which combine readily with the conditions of the particular persons whom it affects; and the combination gathers together the poison of disease in so great intensity that few who are exposed are able to resist it. Under such circumstances those who are healthy, and live temperately and regularly, often escape; while the debilitated, intemperate, irregular livers, generally become victims! An illustration of this fact may be drawn from the history of that terrible disease, the Asiatic Cholera, — a disease which derives its terrific power chiefly or entirely from the accessory or accompanying circumstances which attend it. It bounds over habitation after habitation where cleanliness abides; and generally leaves unharmed those inmates who have preserved and improved their natural constitutions: whilst it alights near some congenial abode of filth or impurity, and finds subjects prepared for easy conquest by previous violations of the laws of health and life.

XVII. We recommend that, in laying out new towns and villages, and in extending those already laid out, ample provision be made for a supply, in purity and abundance, of light, air, and water; for drainage and sewerage, for paving, and for cleanliness.

1. "Light," says the *Liverpool Health of Towns Advocate*, "is necessary to health. Dr. Edwards, of Paris, has shown, that if tadpoles be deprived of light, they do not advance beyond that state of development, however well they may be fed, although they increase in size; and he thence concludes, 'that the

action of light tends to develop the different parts of the body in that just proportion which characterizes the type of the species': and that, in warm climates, 'the exposure of the whole surface of the body to light will be very favorable to the regular conformation of the body.' Baron Humboldt strikingly corroborates this opinion, for he says, after a five years' residence amongst many American tribes, 'I have not seen a single individual with a natural deformity.' We may thus conclude that abundance of light is essential to the proper development of form in man: and it follows, as a consequence, that if children, at the time of early growth, be deprived of this necessary agent, their development will be materially modified, and the foundation for a weak constitution will be laid, and consequent incapacity for labor, and tendency to disease superinduced. Dr. Edwards gives it as his opinion that 'the want of sufficient light must constitute one of the external causes which produce these deviations of form in children affected with scrofula; which conclusion is supported by the observation, that this disease is most prevalent in poor children, living in confined and dark streets.'"

2. Air. We have already spoken of this important element, and shall hereafter refer to works where the subject is fully discussed. Streets should be of sufficient width to permit a free circulation of air. Restrictions should be so imposed as to permit few lanes, alleys, and courts, and none that would so obstruct the circulation as to endanger the public health. Every place from which light is excluded, or into which pure air, in any desirable quantities, cannot at pleasure be introduced, should be pronounced unfit for habitation.

3. Water. The following are the chief conditions in respect of water supply, which peremptorily require to be fulfilled:

1. That every house should be separately supplied with water, and that where the house is a lodging-house, or where the several floors are let as separate tenements, the supply of water should extend to each inhabited floor.

2. That every privy should have a supply of water applicable as often as it may be required, and sufficient in volume to effect, at each application, a thorough flushing and purification of the discharge pipe of the privy.

3. That in every court, at the point remotest from the sewer grating, there should be a stand-cock for the cleansing of the court; and

4. That at all these points there should always and uninterruptedly be a sufficiency of water to fulfil all reasonable requirements of the population.

We must have soft water. All hard waters are expensive, both for domestic consumption and manufacturing purposes. This hardness arises from the presence of earthly and saline substances, which decompose and destroy a certain quantity of soap in washing, and occasion a larger consumption of that article than necessary. It has been proved that the water which supplies Aberdeen contains only one grain per gallon of hardness, while that of Manchester contains fourteen grains. The water at present supplied to Liverpool contains rather more; but we may assume the hardness at fourteen grains per gallon. Now Dr. Playfair has shown that water with fourteen grains per gallon destroys and renders useless a quantity of the soap used for washing purposes, equal in value to 16s. 8d. a year, to a family of five individuals. If we assume the present population of Liverpool at 330,000, and suppose there were a supply of water, of the same quality now used, adequate to the wants of that population, there would be an extra expense of no less than £55,000 a year to the town, in addition to the wear and tear of clothes. Water, however, could not be obtained quite pure, but if it could be had with a hardness of two degrees a gallon, which we believe to be quite possible, a saving would be effected to the town of nearly £50,000 a year; and this without taking into account the saving accruing in manufactories, steam boilers, breweries, etc. It is a low estimate, therefore, to state the hard water tax of Liverpool at £50,000 a year, every farthing of which is actually thrown away, without any return whatever. Now this sum represents a capital of one million and a quarter sterling, at four per cent.[1]

Several cities and villages in Massachusetts have constructed other works besides wells to supply them with water. Boston, by a structure that for artistic skill and thorough workmanship is probably unsurpassed anywhere, has introduced, at an expense to the city of about $5,000,000, the water of Lake Cochituate, nineteen miles and a half distant; and it affords to every inhabitant an abundant supply of water of the best quality.

4. Drains and sewers should be made to carry off water introduced in any way into cities and villages. If the surplus be permitted to remain, it often becomes stagnant and putrid, and is then a fruitful source of disease. "Without a system of drains, a large supply of water is rather injurious than otherwise; yet without a plentiful supply there can be no drainage at all." Every city and village should be surveyed; and the elevations of the crossings of each street above a common level, and its descent to an outer termination, should be laid down and marked upon a

[1] Liverpool Health of Towns Advocate, p. 131.

public plan; so that all abutters, and others interested, may be guided to the proper construction of buildings with reference to drains and sewers. Some general, definitive plan should be fixed upon for each city and village, and when so fixed it should be uniformly carried out under one authority, as circumstances may require. Surface drains will answer for some localities, but underground sewers are generally to be preferred. Boston has about thirty-five miles of such sewers.

5. Paving is of great importance as a sanitary measure. The following are the conditions requisite for a good system:

1. Pavements should be made as impervious to fluids as possible, otherwise the subsoil remains moist, and becomes impregnated with matters deleterious to the purity of the atmosphere. All stone pavements should therefore be closely joined; and consequently those made of round boulders are inadmissible for sanitary purposes. Wood pavements are decidedly injurious to health. The street pavements in some of the Italian cities are better than ours for drainage. They consist of polygonal blocks of limestone, the joints of which are accurately fitted together with cement, so that the rain water flows off as easily as from the roof of a house, and there are neither ruts nor hollows. The old Roman pavements were similarly constructed.

2. Great care should always be taken to prevent the formation of pits and hollows, which are always injurious to health, by permitting the retention of solid and fluid substances in a state of decomposition, and presenting great obstacles to cleansing.

3. All courts and passages should be flagged; the common paving is inadequate for sanitary purposes in such localities.

4. A complete reform should be effected in the manner of constructing street gutters. If any one will take the trouble to go through the town on a wet day, he will be astonished to find how many of these conduits have the property of retaining the water, instead of facilitating its passage into the sewer. It should never be forgotten that a badly made gutter is literally worse than none; for it only draws the foul water from the street nearer the doors of dwellings, while the spaces between the stones allow of its free passage into the subsoil, so as to render the houses more damp than they would otherwise be. Perfect smoothness, and proper adaptation of the stones, along with a proper continuous declivity, are indispensable requisites in a well made gutter.[1]

6. Cleanliness in towns is of such immense importance to health, that it should constitute an indispensable part of sanitary police. The only safe rule is, to remove out of a town, and out of a house, all refuse as soon as it is produced. Refuse matters, either animal or vegetable, are constantly undergoing change, and giving

[1] Liverpool Health of Towns Advocate, p. 99.

out vapors and gases which, even in extremely small quantities, are injurious to health, especially if they are constantly inhaled. Conclusive proofs of this fact exist. Wherever there is a dirty street, court, or dwelling-house, the elements of pestilence are at work in that neighborhood. The cause of many and many a case of typhus fever, cholera morbus, or other fatal diseases, in our cities, villages, and even in the rural and isolated dwellings of the country, may be traced to decayed vegetable matter, or other filth, in the cellar, in or around the house, or in the water used. The most perfect cleanliness is necessary in all places, but especially in confined localities, to preserve the public health; and nothing ought to be permitted to interfere with it. It must never be forgotten that we have to do with life. It is not a question of convenience, or personal annoyance, but one of health. No person, therefore, should be permitted, on any plea of interest, to tamper with this matter; and every nuisance that occasions filth in streets or courts, or that accumulates it on any other surfaces, should be abated; if not otherwise, by the arm of the law. It is sometimes necessary to constrain men to do what would be useful, and to avoid what would be injurious to them. No person should be permitted to contaminate the atmosphere of his own house, or that of his neighbors, by any filth or other substance dangerous to the public health. Such a person should be looked upon as worse than a highway robber. The latter robs us of property, the former of life.

XVIII. We recommend that, in erecting schoolhouses, churches, and other public buildings, health should be regarded in their site, structure, heating apparatus, and ventilation.

XIX. We recommend that, before erecting any new dwelling-house, manufactory, or other building, for personal accommodation, either as a lodging-house or place of business, the owner or builder be required to give notice to the local Board of Health, of his intention and of the sanitary arrangements he proposes to adopt.

XX. We recommend that local Boards of Health endeavor to prevent or mitigate the sanitary evils arising from overcrowded lodging-houses and cellar-dwellings.

XXI. We recommend that open spaces be reserved, in cities and villages, for public walks; that wide streets be laid out; and that both be ornamented with trees.

XXII. We recommend that special sanitary surveys of particular cities, towns, and localities, be made, from time to time, under the direction of the general Board of Health.

XXIII. We recommend that local Boards of Health, and other persons interested, endeavor to ascertain, by exact observation, the effect of mill-ponds, and other collections or streams of water, and of their rise and fall, upon the health of the neighboring inhabitants.

XXIV. We recommend that the local Boards of Health provide for periodical house-to-house visitation, for the prevention of epidemic diseases, and for other sanitary purposes.

XXV. We recommend that measures be taken to ascertain the amount of sickness suffered in different localities; and among persons of different classes, professions, and occupations.

Every person is liable to sickness. The extent of that liability, however, varies in different places and circumstances, and in the same place and circumstances in different ages and seasons. It has some, though not an exact, relation to mortality. Some diseases under some circumstances produce more sickness in proportion to the mortality than others. It has been supposed by Mr. Edmonds, an author entitled to credit ("Lancet," Vol. II, for 1839, p. 185), that the average relation existing between the rate of sickness and the rate of mortality is two years of sickness to each death. "If ailments of a lighter kind are included, the proportion of sickness rises to 2½ years to each death. Assuming two years to be the proportion of sickness to each death at every age, it will follow that the proportion of the living constantly sick at any age will always be double the proportion of the population of the same age dying in one year. If the deaths at any age are at the rate of two per cent, or 1 in 50 per annum, the proportion of the living constantly sick will be four per cent, or 1 in 25."

There are several reasons why this subject should be fully and carefully investigated, and that exact facts in relation to different populations, existing under different circumstances, should be known. We shall allude to two principal ones only:

1. It would subserve a pecuniary purpose.

2. It would subserve a sanitary purpose, and show the exact condition of the people.

XXVI. We recommend that measures be taken to ascertain the amount of sickness suffered, among the scholars who attend the public schools and other seminaries of learning in the Commonwealth.

XXVII. We recommend that every city and town in the state be required to provide means for the periodical vaccination of the inhabitants.

The smallpox is a terrific disease; but it is almost entirely shorn of its terrors by the preventive remedy of vaccination. If a person is not vaccinated, there is more than two chances to one, that, if exposed, he will take the disease; but, if properly vaccinated, there is scarcely one chance in five hundred. Hence the importance of this preventive measure, and the guilt of neglecting it.

Dr. Waterhouse, of Cambridge, vaccinated his son in July, 1800; and this was the first person ever vaccinated in America.

XXVIII. We recommend that the causes of consumption, and the circumstances under which it occurs, be made the subject of particular observation and investigation.

XXIX. We recommend that nuisances endangering human life or health be prevented, destroyed, or mitigated.

Nuisances are divided, in law, into two principal classes: 1. Those which affect the community, or the public, denominated public nuisances; and 2. Those which affect the rights or injure the property of individuals, denominated private nuisances. Some nuisances have a disagreeable and some a pecuniary character only. Others, a vital or sanitary character. The last class, only, immediately concerns this recommendation.

XXX. We recommend that measures be taken to prevent or mitigate the sanitary evils arising from the use of intoxicating drinks, and from haunts of dissipation.

That intemperance is an enormous evil is universally acknowledged. That it is the cause of a vast amount of direct sanitary suffering, — of unnecessary sickness, and of unnecessary death, —

to those who indulge in it; and of a still greater amount of indirect sanitary suffering and death to their associates, relatives, and dependents, is equally true. The evil consequences are so great, and so widely diffused, that they have long since arrested public attention. Good citizens, moral reformers, religious teachers, and other classes of philanthropists, have deplored the evil, and devised various measures for its removal. It still exists, however, and fills the cup of suffering, and provides a premature grave for many and many a person, who might otherwise have lived to become a blessing instead of a curse to humanity. It is unnecessary, however, here to discuss the subject. Through thousands of channels it is brought to public notice. These channels should be widened and deepened, and the number should be increased, until all shall feel their influence. Local Boards of Health, by a careful observation of the sanitary evils of intemperance, and the local and personal circumstances under which they occur, and by adopting and enforcing such sanitary regulations as will remove or mitigate them, may confer an immeasurable benefit upon the people.

XXXI. We recommend that the laws for taking inquests upon the view of dead bodies, now imposed upon coroners, be revised.

XXXII. We recommend that the authority now vested in justices of the peace, relating to insane and idiotic persons, not arrested or indicted for crime, be transferred to the local Boards of Health.

XXXIII. We recommend that the general management of cemeteries and other places of burial, and of the interment of the dead, be regulated by the local Boards of Health.

Boards of Health should make an exact survey and plan of each burial-ground in their respective towns, on which should be drawn and numbered separately, each family or personal lot, each tomb, and each grave; and these numbers should be entered in a record-book, and against each the name of the individual or individuals interred therein. These records should, as far as practicable, contain the names and location of the tenants already there, as well as new ones. Undertakers should return the number of the lot, tomb, or grave, to be entered under " place of interment," in

the records of deaths. All these records should be carefully preserved, so that any person may be able to identify the exact spot where a friend or connection was deposited. The precise quantity of land, in acres or parts of acres, in each ground, should be entered on the plan.

XXXIV. We recommend that measures be taken to preserve the lives and the health of passengers at sea, and of seamen engaged in the merchant service.

Without attempting in this place to recommend a specific system of sanitary regulations for ships, we urge, in general terms, upon merchants, sea-faring men, and others interested, the great importance of the subject. Dryness, ventilation, and cleanliness, should be enforced in every department of the ship; foul and putrid cargoes should be avoided; and every means used, by proper diet and regimen, to preserve the health of the seamen and passengers. Sanitary improvement was early introduced on board ships, as we shall presently show; and a great number of human lives have consequently been saved. In no department of social economy can preventive measures have a greater influence. Boards of Health might do a good service to humanity, by issuing a simple and judicious code of sanitary regulations for ships.

XXXV. We recommend that the authority to make regulations for the quarantine of vessels be intrusted to the local Boards of Health.

XXXVI. We recommend that measures be adopted for preventing or mitigating the sanitary evils arising from foreign emigration.[1]

The state should pass suitable laws on the subject, and the general and local Boards of Health should carefully observe these evils in all their sanitary bearings and relations. We would, however, suggest —

1. That emigration, especially of paupers, invalids, and criminals, should, by all proper means, be discouraged; and that misrepresentation and falsehood, to induce persons to embark in passenger-ships, should be discountenanced and counteracted.

[1] Immigration. — Ed.

2. That ship-owners and others should be held to strict accountability for all expenses of pauper emigrants, and that existing bonds for their support should be strictly enforced.

3. That a system be devised by which all emigrants, or those who introduced them, by water or by land, should be required to pay a sufficient sum to create a general sinking fund for the support of all who may require aid in the state, at least within five years after their arrival.

4. That such a description of each emigrant be registered as will afford the means of identification of any one, at any time, and in any place, within five or more years after arrival.

5. That encouragement be given to emigrate from places in this state, where there is little demand for labor, to other places; and that associations be formed among the emigrants for settling on the public lands of the United States.

6. That efforts be made, by all proper means, to elevate the sanitary and social condition of foreigners, and to promote among them habits of cleanliness and better modes of living.

7. That our system of social and personal charitable relief should be revised and remodeled, and that a general plan be devised which shall bring all the charities of the city, county, and state, under one control, and thus prevent injudicious almsgiving and imposition.

8. That an establishment for paupers, including a farm and workshops, be formed in each county in the state, to which state paupers might be sent, and where they should be required to labor, as far as practicable, for their support.

XXXVII. We recommend that a sanitary association be formed in every city and town in the state, for the purpose of collecting and diffusing information relating to public and personal health.

XXXVIII. We recommend that tenements for the better accommodation of the poor be erected in cities and villages.

The condition of dwelling-houses has a most intimate and important relation to the health of the inmates; and there is no doubt that the diseases of the laboring classes and the poor are often produced and accelerated to fatal results, from defects in these respects, which are removable.

In 1846, a meeting of the citizens of Boston was held, and a valuable " Report of the committee on the expediency of providing Better Tenements for the Poor " was adopted and published. After stating many interesting particulars relating to the subject, the committee came to the conclusion:

1st. That property invested in well-constructed and well-situated houses, to be leased to the poorer classes of tenants, by apartments and by the week, is as safe as any other real estate excepting the best, and far more so than the average.

2d. That it yields as much as any real estate which is equally safe.

3d. That, by putting a portion of his funds into such buildings, the capitalist may confer an immense benefit on his fellow-citizens, which must soon react upon himself or his children.

4th. That he would thereby incur no risk of doing a collateral injury, such as, in many forms of charity, goes so far to offset the most obvious benefits.

XXXIX. We recommend that public bathing-houses and wash-houses be established in all cities and villages.

Within the last few years, a new movement for the general and sanitary benefit of the poor has been made, in the establishment of public bathing-houses and wash-houses. Liverpool has the honor of originating the idea, and of erecting the first institution, which was opened the 28th of May, 1842. A second one was erected there in 1847.

XL. We recommend that, whenever practicable, the refuse and sewage of cities and towns be collected, and applied to the purposes of agriculture.

The refuse and sewage of cities and villages are of great value as manure; and plans have been devised abroad to collect and apply them for agricultural purposes. Companies have been formed, estimates made, and experiments tried, to test their value, and to devise the best means by which they might be used. As to their great value all agree; but the different plans of collecting and distributing them seem not as yet so fully tested as to warrant a recommendation of any particular one in preference to others. We insert some extracts from different works, and recommend the subject to the careful examination of those interested. Public urinals and public privies should be erected in every populous city and village, and placed under regulation of public authority, for the purpose of convenience, economy, and health.

XLI. We recommend that measures be taken to prevent, as far as practicable, the smoke nuisance.

The smoke of furnaces, manufactories, and other establishments, is often a great nuisance to a neighborhood, and is supposed to be deleterious to health. It corrupts the air, and often renders it unfit for respiration; and all proper and practicable measures should be adopted to prevent the evils which result from it. Experiments have been made, in the manufacturing towns in England, to construct furnaces and fireplaces so as to burn up the smoke, as fast as produced, and thus prevent its escaping, to become an inconvenience, nuisance, or injury to the inhabitants. These experiments have shown that the arrangement is an economical and practical as well as a sanitary improvement. Less fuel is required when the smoke is burned than when it is permitted to escape unburned. We desire to call the attention of all interested to the subject, as worthy of careful investigation. Several important facts and illustrations relating to this subject may be found in recent English sanitary publications.

XLII. We recommend that the sanitary effects of patent medicines and other nostrums, and secret remedies, be observed; that physicians in their prescriptions and names of medicines, and apothecaries in their compounds, use great caution and care; and that medical compounds advertised for sale be avoided, unless the material of which they are composed be known, or unless manufactured and sold by a person of known honesty and integrity.

XLIII. We recommend that local Boards of Health, and others interested, endeavor to prevent the sale and use of unwholesome, spurious, and adulterated articles, dangerous to the public health, designed for food, drink, or medicine.

The evil suggested in this recommendation is nearly allied to that preceding. It is one of immense magnitude and importance, and exists to an extent greater than has been generally supposed. Prodigious quantities of spurious articles, of food, drink, and medicine, which are highly injurious, are daily palmed upon the public by mercenary and fraudulent manufacturers and dealers. And it is generally conceded that a great amount of disease and numerous premature deaths are thereby produced.

Food is adulterated in various ways. A recent writer enumerates the following purposes of these adulterations:

1. To make the substance more saleable by improving its appearance, by the addition of some body innocuous or otherwise.
2. To depreciate its quality, by adding to it some substance which will diminish its real, without altering its apparent strength or general appearance. This is generally a very deadly fraud.
3. To depreciate its quality by the addition of some simple substance, as water, or, if it be a solid body, as plaster of paris, sand, etc.

Bread is often adulterated with alum, carbonate of ammonia, carbonate of magnesia, sulphate of copper and zinc, etc., to improve its appearance, when made of flour of inferior quality. Butter and cheese are often poisoned with coloring matter. Milk is watered, sugar sanded, and various other intentional frauds are practiced. Unintentional adulterations may also sometimes take place by means of keeping or cooking different kinds of food.

Drink is also very extensively adulterated. It is said that very little of what is sold as champagne wine is made from the juice of the grape, but is a deleterious compound of other substances. Few of other kinds of spirituous liquors go to the consumer in a pure state. It is the opinion of eminent temperance reformers that one of the principal causes of the sad sanitary effects of intemperance arises from the poisonous substances compounded with the pure spirit and taken in the intoxicating cup. Other kinds of more ordinary drink, not intoxicating, and even water itself, may be adulterated and rendered unfit for use.

Drugs and medicines have been adulterated by the foreign producer, manufacturer, and dealer, expressly for the American market, and vast quantities of such articles have been imported and sold in this country. Some of our own producers, manufacturers, and dealers, also, have been guilty of a similar fraud. By careful study the properties and mode of operation of the various articles used as medicine have been ascertained, and the intelligent, conscientious, curative physician, can estimate their effect with some degree of accuracy. It is necessary, however, to enable him to do this successfully, that they should be of known purity and strength. If spurious, of inferior quality, or adulterated with other substances, not contained in the genuine article, disappoint-

ment follows, and the patient suffers and perhaps dies. This result may happen under the advice of the best curative medical skill, and life may be, and has actually been lost, from some defect existing alone in the medical remedies used. A mere statement of this fact will render obvious the importance of this recommendation.

XLIV. We recommend that institutions be formed to educate and qualify females to be nurses of the sick.

It is hardly necessary to commend the importance of good nursing in the cure of disease. Let a physician be ever so skilful, and prescribe his remedies with ever so much care and sagacity, if the nurse does not follow his directions, or if she neglects her duty, or performs it unskilfully, or imperfectly, or with an improper disposition, the remedies will be unsuccessful, and the patient will suffer; and perhaps life is lost as the consequence. On the other hand, let a physician of moderate capacity prescribe with ordinary skill, if his orders are carried into execution by a nurse, who understands, loves, and conscientiously discharges her duty, the patient is relieved, and life is preserved as the consequence. It is thus that bad nursing often defeats the intention of the best medical advice, and good nursing often supplies the defects of bad advice. Nursing often does more to cure disease than the physician himself; and, in the prevention of disease and in the promotion of health, it is of equal and even of greater importance. Many and many a life, which might have been saved, has been lost in the hands of quack nurses, as well as in those of quack doctors.

XLV. We recommend that persons be specially educated in sanitary science, as preventive advisers as well as curative advisers.

The great object of sanitary science is to teach people the causes of disease, — how to remove or avoid these causes, — how to prevent disease, — how to live without being sick, — how to increase the vital force, — how to avoid premature decay. And one of the most useful reforms which could be introduced into the present constitution of society would be, that the advice of the physician should be sought for and paid for while in health, to keep the patient well; and not, as now, while in sickness, to cure disease, which might in most cases have been avoided or prevented. And

this practice, we understand, exists to some extent in some civilized countries. Three existing reasons, however, now occur to us, which we fear will prevent or obstruct, at least for a considerable period, the introduction into our country of this useful reform. One reason is, that persons who are well generally think that they have no need of a physician; another, that if advice is sought for or given at such times, it is not generally considered worth paying for; and a third, that there are few persons educated in sanitary science, and capable of giving good sanitary advice. These are fatal errors, and should be corrected, for they have cost thousands of lives. Sanitary professorships should be established in all our colleges and medical schools, and filled by competent teachers. The science of preserving health and preventing disease should be taught as one of the most important sciences. It would be useful to all, and to the student in curative medicine as well as to others. To the young man who is educating himself for the great purposes of life, whatever profession he may select, it cannot be inferior, in interest and importance, to any other branch of education.

XLVI. We recommend that physicians keep records of cases professionally attended.

The science of medicine, like most other sciences, is founded upon facts. Many of these facts are stated in the recorded observation and experience of the profession, gathered up and handed down to us in the accumulated medical literature of the age. In anatomy and physiology (and in surgery, too, to some extent), branches of this science, truth and demonstration may be found; but in the practice of medicine more uncertainty exists. The great variety of diseases, and the infinite and ever-varying forms in which they appear in living individuals, render it very difficult to ascertain, always, what their exact natures are, or what appropriate remedies should be applied for their removal. And in looking over the history of medical practice, as exhibited in the books, it is curious to observe how many successive theories have been set up by one man or set of men, and have been overturned and demolished by another, or abandoned by the authors themselves. The cause of this great variety and change of opinion is to be found, either in an honest desire for the truth, and a belief that it

has been discovered, or in a desire to introduce some new theory, that may attract notoriety and promise wealth to its advocates. This has given rise to the numerous medical systems and denominations which have existed and continue to exist. The great error has been in forming theories upon observations or statements, without duly inquiring whether they have been sufficiently numerous, and have been carefully and truthfully made, upon a uniform and comprehensive plan, or whether they are otherwise imperfect. Any theory, however plausible, resting upon a basis in which imperfection exists, is liable to be overthrown.

One great desideratum seems to be a register of cases, for private professional practice, constructed on a plan so simple in its requirements, so convenient in its form, at so low a cost, and so comprehensive in its design, that it shall commend itself to universal favor, and be universally used. If such a desirable end could be attained, means would be provided, which have not hitherto existed, to illustrate the causes, nature, effects, and treatment of disease. The abstracts of a large number of authentic registers, if properly presented to the public, would, it is believed, overthrow and destroy much of the medical theory and practice of the age, and introduce a more natural, rational, and successful system.

XLVII. We recommend that clergymen of all religious denominations make public health the subject of one or more discourses annually, before their congregations.

XLVIII. We recommend that each family keep such records as will show the physical and sanitary condition of its members.

Between the sanitary condition of families and of the state an intimate relation exists. What affects the former must of course affect the latter. And reform, if begun at all, must first commence in these primary communities. It is here that those great principles of sanitary improvement, which promise such favorable results, must first be adopted and developed. A system of simple but exact observations, concerning the physical condition and progress of the different members of the family, would greatly aid all concerned in the adoption of such a plan of management as would promote their highest welfare and improvement.

XLIX. We recommend that parents, and others to whom the care of those in infancy and childhood are intrusted, endeavor to understand and discharge their duties so that a good foundation may be laid for vigorous manhood and old age.

L. We recommend that individuals make frequent sanitary examinations of themselves, and endeavor to promote personal health, and prevent personal disease.

If there is a fault in the printed discussions of sanitary reformers, it is in attaching too much importance to public, and too little to personal measures, for the promotion of health. The causes of disease may be diffused in the atmosphere, or may exist in a locality, or may be connected with the individual himself. If the person be well fortified and well guarded, little need be feared from an unseasonable invasion of the enemy from without; but if otherwise, its onset will be easy, and its victory certain. This is a matter in which uncertainty should, as far as possible, be excluded. We should not guess at the value of life, or the mode of preserving it. Every person should know, by his own observation and experience, his own capabilities and his own liabilities; and make the matter of preserving his health and continuing his life a subject of the same care and prudent forethought, and apply to it the same intelligence and sagacity, that he uses in any or all of his ordinary affairs.

Every person should make frequent sanitary investigations relating to himself. The history and condition of his constitution should be studied. The hereditary organization and tendency, and the character of the blood that courses in his veins, should be ascertained. The alterations of the original constitution, produced by disease, habits of life, or any other means, and the causes of these alterations, and the remedies that have been used to counteract and prevent their effects, should also be carefully studied and noted. The influence of various habits and actions upon the organs and functions of our bodies, whether relating to their protection, nourishment, or preservation, should be carefully observed; and such as are found to be favorable should be repeated, and such as are known to be unfavorable should be discontinued. Everything which may excite or develop an

unhealthy tendency, hereditary or acquired, should, as far as possible, be avoided; and everything of an opposite tendency should be done to check such development.

Our persons should be protected, and kept in uniform temperature, by clothing of the right kind, properly made, and worn at such times, in such a manner, and in such quantities, as are best adapted to promote health. Disease should not be allowed to invade the system by means of too little or too much clothing, or through any other defect or imperfection; but each person should wear just such clothing, at all times, as will involve the least risk, and produce the greatest vigor and physical enjoyment.

Our persons should be nourished by food of the right kind, properly prepared, and taken at such times, in such a manner, and in such quantities, as will promote the greatest vigor. We should "eat that we may live, not live that we may eat"; take food to nourish us, not to satiate a depraved appetite; and adapt our food and our regimen, at all times, to the present physical and sanitary condition of the body. When debilitated and fatigued, we cannot take with impunity the same kind or quantity of food as when in a different condition.

Our persons should be preserved and strengthened by wise and uniform care and training. We should cleanse our persons by daily ablutions, properly applied, at suitable times, and of the right kind and temperature; strengthen our persons, physically and intellectually, by regular and progressive, not transient and excessive, exercise and labor, at such times, to such extent, and in such places, as will be most invigorating; and should refresh our persons by rest and sleep, at proper times, in right places, by suitable means, and in sufficient quantities.

What is right and suitable and proper, in each of these cases, must be determined by each one's own intelligence, observation, experience, feelings, and condition, ascertained by himself. If careful personal sanitary examinations were frequently made in this way, and personal health was guarded and improved by these means, we should hear less of the ravages of cholera, typhus, and other epidemics, and of isolated sporadic diseases.

CHAPTER XX

REASONS FOR APPROVING THE PLAN RECOMMENDED

We have presented, in the preceding pages, some of the principal measures that have occurred to us as worthy of being embraced in a plan for a sanitary survey of the state, which we recommend for adoption. We might have included other collateral subjects, and might have given a more full explanation and illustration of those already presented, but the occasion did not seem to require it or make it necessary. Our design will have been accomplished if our recommendations have been explained sufficiently to be generally understood and capable of being reduced to practical operation. We claim for the whole plan, and for each part of it in connection with the other parts, a careful consideration before judgment is passed upon it, and when so considered we have great confidence that we shall have the approval of all candid minds. We have already given, in the illustrations of the several recommendations, many reasons for their approval; and they are sufficient, it is supposed, to incline most intelligent minds in their favor; we might safely leave the subject here without further discussion. There are, however, some general considerations in favor of the plan which we deem it proper to present.

I. It should be approved because it is a practical measure.

The great outline of the plan is the establishment of a central general Board of Health for the whole state, and a local Board of Health for each city and town in the state; each to be composed of competent men, who are to have the general superintendence of all matters relating to the public health within their respective jurisdictions. These Boards, having the assistance and co-operation of the people in all parts of the Commonwealth, would be able to bring to bear, by a practical, systematic, uniform, and efficient plan, a vast number of minds and a great amount of intelligence upon the subject of health, and upon the causes and prevention of disease; and it is impossible to foretell the immense

advantages which might result from the facts they might collect, and from the discoveries they might make, relating to the number of lives saved, the prolongation of the periods of human existence, and the diminution of human suffering.

And what is the design, what are the purposes of this measure? What will it probably accomplish, if carried into execution?

It would save life. In Boston, during thirty-nine years, 1811 to 1849 inclusive, 62,431 deaths took place, of which 2,079, or 3.33 per cent only, were from old age, and 96.67 per cent from diseases and other causes; and for the year 1849 it appears still more unfavorable, being 5,079 from all causes, and 95, or 1.87 per cent only from old age, and 98.13 per cent from other causes. Is it not a practical measure to prevent some of this great amount of disease, and assist some of these lives that they may grow old, and die only because they are old?

It would prevent sickness. We have stated that the estimated rate which sickness is supposed to bear to the population is double the rate per cent of the annual deaths. This rule, if applied to our population, would indicate, in the opinion of some, too much, and of others too little sickness. But assuming it to be nearly the average, until we get more perfect returns, let us make the application. The average number sick during the whole year, in a healthy country town, is ($1\frac{1}{2} \times 2$) 3 per cent of the population; and in Boston for the last nine years (2.53×2) 5.06 per cent, and for the year 1849 (3.84×2) 7.68 per cent. According to this rule, if Boston had suffered no more than a healthy country town, she would have had but 3,960 persons constantly sick, or suffered that number of years' sickness in the aggregate, instead of 9,837; showing an excess of unnecessary sickness, for that year only, of 5,871 years!

It would increase the vital force. We have presented the loss of life and the amount of sickness as two of the great evils which the people suffer. Another is found in the vast amount of impaired health and physical debility which exist among those not actually disabled by sickness. Many, very many, move feebly about, discharging imperfectly the great duties of life, and have not the capacity to perform the labor which perfect health allows.

The aggregation of all the physical powers, the original organization, the united energies of the nutritive, respiratory, cutaneous, locomotive, and nervous actions, and the predominance of the vital over the chemical affinities, co-operate in the production of vital force; and these together make up what is commonly called the constitution of man, — that is, his power for labor or endurance, — his power of accomplishing his purposes, or resisting the causes of injury.

This constitution, or this quantum of vital force, may be considered as the capital of life, with which man operates, does all his work, enjoys all his pleasures, and sustains himself in his present being. . . .

In 1842, the Hon. Horace Mann, as Secretary of the Board of Education, proposed to several physicians, the following question: "How great a proportion of disease, of suffering, of diminution of physical capacity, of usefulness, and of abridgment of life, comes from sheer ignorance, and which, therefore, we might hope to see averted, if the community had that degree of knowledge which is easily attainable by all?"

To this question Dr. James Jackson, of Boston, replies, "I feel assured that the answer should be more than one-half. When it is brought to mind that the ignorance of parents is included in the terms of the inquiry, the justice of the answer will probably be admitted by all who are conversant with the subject."

Dr. S. B. Woodward, late superintendent of the State Lunatic Hospital, says, "I have no doubt that half of the evils of life, and half the deaths that occur among mankind, arise from ignorance of the laws of health and life; and that a thorough knowledge of these laws would diminish the sufferings incident to our present state of being in very nearly the same proportion."

Dr. Edward Jarvis replies, "From an observation of thirteen years, I have been led to believe that three-fourths, perhaps more, of the ailments of men come from a want of sufficient knowledge of their frame, or a disregard for it."

Dr. Marshall S. Perry, from a special record, estimated that more than half of a given number of cases of sickness might have been avoided, by knowledge, attention and care.[1]

II. It should be approved because it is a useful measure.

If the important practical results, which have been detailed, would follow the adoption of our plan, it is unnecessary that any-

[1] Mann's Sixth Annual Report, p. 84.

thing further be said to show that it is a useful measure. To save life, to prevent sickness, and to invigorate the human frame, are its objects; and none can be of greater utility.

It would give the state a knowledge of its inhabitants. Hasty legislation, based upon imperfect knowledge, is one of the evils of this republic. It prevails, to a greater or less extent, in all the legislatures, national, state, and municipal. It is the practice of some governments, when measures deemed worthy of legislation are proposed, to appoint a commission or committee to make a thorough investigation of the whole subject, and to report the facts and the evidence. A bill is then carefully drawn, based upon the facts thus disclosed, and adapted to the exigencies of the case. This is enlightened, effective, useful, and economical legislation. England is much indebted for her greatness and power to this practice; and her example, in this respect, is worthy of imitation. The very reverse of this, however, too often happens in the United States. We too often legislate first, and obtain the facts, if we obtain them at all, afterwards. An exact knowledge of the circumstances of the people is the surest basis for correct and useful legislation.

It would aid the physician. This would be done in various ways. The information obtained would be of immense consequence in giving him exact knowledge of the causes and prevalence of different diseases. This knowledge would greatly aid him in applying his remedies for prevention and cure. Instead of partial facts, obtained for a partial purpose, upon which to ground his theories, he would have a vast collection of impartial facts, truthfully gathered, for no other purpose than the promotion of truth. On such a basis he might construct a much better theory in medicine, and devise a more rational, philosophical system of remedies.

But there is another purpose which they would secure in this relation. One of the most trying circumstances in the life of a conscientious physician is believed to be the capricious and unfounded judgment which the people often pass upon his skill and professional services. This opinion is frequently the result of accident or prejudice, combined with imperfect knowledge or

entire ignorance, and would be changed if the people were better educated in sanitary science. This is an interesting consideration, and might be abundantly illustrated in the experience of every physician; but the mere suggestion is deemed sufficient for our purpose, to show that this is a useful measure to the medical profession.

It would benefit the people. We have already alluded to the murderous imposition which is practiced upon a credulous people, by pretenders to medical skill, in curing disease, and by mercenary dealers in injurious nostrums and drugs. This matter may be again alluded to for a more general purpose. Though health is a matter in which every person is directly interested, yet there is scarcely any subject on which so much ignorance generally prevails. When well enough to do without medical advice, we are too apt to neglect to inform ourselves as to the means of avoiding the contingency of sickness. But when attacked with real or imaginary sanitary ills, no people are more liable to err, or can be more easily imposed upon. The body is subjected to experiments, by new advisers and new remedies, come from whatever quarter they may; and faith is put in certificates, which perhaps have been forged.[1] Many, very many, are thus drugged to death, either by the blind guides of their own uninformed minds, or the unfounded pretensions of others. The object of this measure is to diffuse, among all classes of people, more enlightened views of life, health, and disease. In this way it is believed numerous lives might be saved, a great amount of sickness prevented, and a corresponding amount of suffering avoided. Is not this a useful purpose?

III. It should be approved because it is an economical measure.

The expense of preventive sanitary measures is the most common argument brought against their adoption. Epidemics are considered by the ignorant as evils which it is useless to attempt to prevent; and among the better informed, a false idea of economy, which has sometimes led to the most fatal results, has been the ground of resistance to measures which were necessary

[1] It is not necessary to remind the reader that this was written nearly seventy years ago. — Ed.

to save life. It should, however, be known that public expenditures cannot be avoided during the prevalence of an epidemic disease. Money must be spent, either in saving life, or in the maintenance of pauperism, widowhood, and orphanage. In this case economy is on the side of humanity, and the most expensive of all things is to do nothing.

Debility, sickness, and premature deaths are expensive matters. They are inseparably connected with pauperism; and whenever they occur they must, directly or indirectly, be paid for. The city or town must pay for the sick man's support — for his food and clothing, for medical attendance on him during life, and for the support of his widow and children (if he leave any) after his death. A town in which life is precarious pays more taxes than its neighbors of a different sanitary character. An individual who is unable to perform a large amount of labor, or no labor at all, is a less profitable member of society than one who can do whatever vigorous health allows.

The expenses and losses entailed by a neglect of sanitary measures may be classed under the following heads: 1. Expenses imposed upon the poor, by loss of work or of situations, for medical attendance and medicine, for nursing, for funerals, for the support of widows and orphans, and for other purposes. 2. Expenses imposed upon the tax-payers, for the support of those who are unable to support themselves, besides their own increased expenses arising from a bad sanitary condition. 3. Burdens imposed upon the charitable, for the support of hospitals, dispensaries, and for other more general or special charities. 4. A loss sustained by the state, in consequence of the diminished physical power and general liability to disease. 5. Expenses imposed upon the community, by the crimes arising from the unfavorable physical circumstances by which the laboring poor are surrounded, and which lead with certainty to their moral degradation.

All necessary expenses for this object may be easily provided for. If the different items of state expenditure, as given by the State Auditor, were examined, several may be found that seem to us unnecessary, or that might be reduced so as to meet all the cost of this most important measure. It would be easy to specify

such items. The Legislature costs about $1,000 per day while in session. By shortening the session three days only, enough might be saved to pay the annual expenses. As much is paid to the Bank Commissioners as would be required for the Board of Health; and it is supposed that all the advantages which result from that commission might be obtained in some other way without any expense. Other items might be specified with equal propriety, and many may be found of doubtful expediency as compared with this. Any candid mind can make his own selection. But suppose we let them all stand as they now do, the adoption of our measure would reduce the cost of supporting state paupers, now incurred on account of unnecessary sickness and deaths, more than sufficient to pay all expenses several times over. And if a direct tax were laid upon the people for its support, though unnecessary, it would be, on the average, less than three mills to each person! Who would not consider this a very insignificant expenditure for so noble a purpose?

IV. It should be approved because it is eminently a philanthropic and charitable measure.

We have recently witnessed three of the greatest nations of the earth lending their aid to discover and save a single adventurous navigator, who sailed for the northern regions of this continent to make discoveries, which, if made, would probably have conferred no substantial benefit on mankind. And one of the sons of Massachusetts, with characteristic liberality, has offered, at his own expense, to equip a fleet to continue the search, if the government will provide officers and men. In a beautiful allusion to this matter, Hon. Horace Mann said: "Thus the three most powerful governments in Christendom express their regret and proffer their assistance for the recovery of a single man, — Sir John Franklin. And yet you cannot pass through one of the great streets of this or any other of the cities of this country, you cannot go through the most secluded town or village in all this broad land, without meeting some juvenile Sir John Franklin, some great man in embryo, more valuable, and of more consequence to futurity, than the one who, we fear, now lies buried beneath the icebergs of the Arctic Ocean. All these Sir John Franklins, aye, and Dr. Franklins too,

and other names of potential and prospective greatness, who have within them the latent powers which, in their full development, might bless and regenerate the world, are scattered all over this country; but none of the three great nations of Christendom offers its sympathy or succor, or extends an arm for their deliverance from a fate which is as much worse than to be buried beneath the snows of the Arctic, as moral perdition is more terrible than physical."

Yes; and we say if the money that has been thus expended, — if the lives that have been lost in trying to save one life, — had been applied to the discovery of the physical circumstances of the great mass of the people, in the application of useful remedies for their improvement, in saving their lives, and in elevating their social and sanitary condition, then, instead of one life saved, the number would have been thousands.

A Humane Society has existed in Massachusetts since 1786, "for the purpose," says an early historian, "of restoring suspended animation, preserving human life, and alleviating its miseries." "Discreet and concise directions for the recovery of persons apparently dead, from drowning, strangling, suffocation, electricity, or the use of poisons; judicious rewards to such as have jeoparded their lives for the preservation of others, and furnishing convenient shelters, on our sea coast, for ship-wrecked mariners, have extensively diffused the benefits of this benevolent institution." Up to 1830, over $20,000 had been expended in promoting its objects. Medals and gratuities have been awarded to meritorious services in saving life. Similar rewards have been generously granted by the government of Great Britain for the aid afforded by American seamen to foreign seamen in distress. A very large number of other voluntary associations exist in this state; and the hand of private charity is widely opened for the cure of diseases, for relief in sickness, for the support of widows and orphans, and for various other similar objects of benevolence and charity. Too much cannot be said in praise of these noble institutions, from which flow so many streams of "oil and wine," to comfort and bless humanity; but it may be well to inquire whether there is not another and still more noble object of philanthropy.

The evils which it is the object of these institutions to relieve may be called the diseases of society. By them all our cities and towns suffer. The remedies lie deeper and farther back. All along we have endeavored to prove that "prevention is better than cure"; and the distinction we have made between the curative and the preventive physician might with great propriety be applied to these institutions as the curative measures, and to others which might be adopted as the preventive measures. These are the removal of the causes which produce the misery which these streams of benevolence are applied to alleviate. On this deep and broad foundation lie the measures we recommend; and they should be approved as the first, the greatest, and most important objects of philanthropy and charity. If we would relieve sickness we must remove the causes of sickness, and prevent it; if we would relieve insanity, and deafness, and blindness, we must remove the causes of insanity, and deafness, and blindness; if we would prevent premature deaths, and premature old age, we must remove their causes; if we would provide against widowhood and orphanage, we must remove the causes of widowhood and orphanage; and so of every other evil which it is the object of these charities to alleviate.

V. It should be approved because it is a moral measure. "There is a most fatal and certain connection," says the *Edinburgh Review* (vol. xci, for April, 1850, pp. 384, 386), "between physical uncleanliness and moral pollution. The condition of a population becomes invariably assimilated to that of their habitations. There can be no sight more painful than that of a healthy, rosy, active countrywoman brought to one of these dwellings. For a time there is a desperate exertion to keep the place clean; several times in the forenoon is the pavement in the front of the house washed, but as often does the oozing filth creep along the stones, and she feels, at length, that her labor is in vain. The noxious exhalations infuse their poison into her system, and her energies droop. Then she becomes sick. Cleanliness becoming impossible, she gets accustomed to its absence, and gradually sinks into the ways of her neighbors. The art of concealing dirt is substituted for the habit of cleanliness; she becomes a dirty, de-

bilitated slattern, followed by sickly, scrofulous, feverish children; and she falls through successive stages of degradation, till, physical wretchedness having done its worst, she reaches the lowest of all, that in which she has ceased to complain. The fate of the children is, if possible, more heart-breaking. All idea of sobriety, all notion of self-respect, all sense of modesty, all instinct of decency, is nipped in the bud; they congregate in masses, and mix with the worst vagrants. At last some dreadful fever forces on the notice of the public the existence of their squalid dens of misery; such as those in the Saffron Hill district, — where twenty-five people were found living in a room sixteen feet square, — where a man and his wife and four children, occupying one room, took in seven lodgers, — and where one house contained a hundred and twenty-six people, and only six or seven beds. These people save nothing, but invariably spend all they earn in drink; and with that precocious depravity too surely evinced by human beings when herded together like beasts, the young of both sexes live together from the ages of twelve and thirteen years."

" The indirect effects of sickness are far more hurtful, though less observable, than the direct effects of mortal disease."

The object of the measures we recommend is to remove filth and prevent disease, to introduce those accommodations which allow, and reform those habits which prevent, the elevation of the physical man, the social nature and moral condition of our fellow-beings. They are the best handmaids we can give to prosperity, to morality, and to religion.

VI. It should be approved because the progress of the age demands it.

The half century just now drawing to a close is a wonderful period in the world's history. Inquiry and discovery have been abroad in the earth. New facts and new truths have been ascertained — new sciences have been developed, and the boundaries of old ones have been greatly enlarged. These discoveries have produced revolution after revolution, — have multiplied the means of convenience, comfort, pleasure, and luxury, — until our social and practical life is a very different thing from the social and practical life that existed fifty years ago. And were it not

that we have grown up with the results, they would appear almost beyond the limits of reality or possibility.

The Sanitary Reform we advocate lies chiefly in another field of observation and discovery, which has as yet been very imperfectly explored. This may be called the Province of Prevention — prevention of disease — prevention of suffering — prevention of sanitary evils of every kind; and the efforts of those who enter this hopeful province should be directed to the discovery and the means of removal of the causes of these evils. Every effect must have a cause — every disease has its cause. And the effort should be to ascertain the exact relation which one bears to the other — what known, exact, and positive causes will produce a known, exact, and positive disease, or a sanitary evil of any specific kind, and none other. And is not this as far within the limits of possibility and certainty as is the treatment and eradication of disease? Cannot the exact nature of an atmospheric, local or personal cause of disease, and the exact personal condition with which it most easily assimilates, and which it most easily affects, be definitely and accurately ascertained? If such a desirable discovery could be made, what manifold blessings on humanity would it confer! We know that a human body, unaltered from its original organization or functions, coming in contact with the virus of smallpox, either inhaled while floating in the atmosphere, or imbibed by outward contact or inoculation, will produce a specific effect, — a specific disease. Here is cause and effect of a known and exact relation to each other. We know, too, that vaccination, properly performed, will alter the original organization or functions, so that the same virus will not in either way take effect. Here is another exact cause and effect whose relations are equally known. This is a discovery which has, within the last fifty years, saved thousands and thousands of lives, and might have saved thousands more, had it been universally applied. Now it is but fulfilling the demands of the age to press inquiries vigorously, and to endeavor to discover the causes of every disease which may attack the human body. If the same exact and definite information could be obtained, as to the causes of cholera, dysentery, scarlatina, typhus, consumption, and the other grave

diseases, to which we are subject, and as to the particular condition of the individual which they most easily affect, how much might be done for the avoidance of those diseases by the removal of their causes! How many lives might be saved, how much suffering might be prevented! Does not the spirit of the age then demand the approval of a measure which promises to do this great, most important work ?

VII. It should be approved because it involves an important duty.

If a measure is practical, useful, economical, philanthropic, moral, and demanded by the spirit of the age, it needs no argument to show that it is our duty to approve it. And if such is our obligation, nothing further need be said. For, in our judgment, whoever violates a known duty is guilty of crime, and justly makes himself liable to its penalties.

VIII. It should not be disapproved because objections may be brought against it.

In the previous pages we have anticipated answers to some of the objections that may be brought against this measure. There are some others, however, which require to be noticed.

1. It may be said, " Your plan is too complicated; you require too much; it will not and cannot be carried into operation."

Before characterizing any measure, a candid mind will at least examine, and endeavor to understand it. There are some persons, however, who, even without previous study or knowledge, and by a mere casual glance, deem themselves qualified to give an intelligent opinion whether a measure has merit or demerit. Sometimes a plan may appear complicated before examination, but simple afterwards. It has been the fate of new measures, generally, to be thus hastily judged. It was so in the first stages of the sanitary movement in England; and it is not supposed that our recommendations will be exceptions to the general rule.

The plan for taking the census of Boston, in 1845, was opposed by some, at its first introduction, because it was alleged to be impracticable and useless. The result, however, proved it otherwise in both respects; and the same plan, substantially, has since been approved and followed in other cities, and has this year been

adopted for taking the seventh census of the United States. It was said that the laws for the registration of births, marriages, and deaths could not be carried into operation; and no special attempt was made to do it in Boston until 1849, when, by a simple ordinance, it was successfully done.

2. It may be said, "The measure is not applicable to this state; it may be well enough in some other places and countries, but we do not suffer evils which require such remedies for their removal; no people are more healthy than we; we are well enough as we are."

We most cheerfully and most gratefully admit that in some of our towns, and among some classes of our people, sanitary evils do not exist to so great an extent as in some other places. But while we admit this, we affirm, from the most authentic evidence, that in many places and among many classes of our population, in many families and among many persons, there is scarcely to be found, anywhere, more ignorance of the laws of health, more disregard to proper sanitary regulations, and more suffering for their neglect. Our towns, our cities, and our dwelling-houses, it is true, are not so old, nor do many of them have so forbidding an exterior, as many in Europe; but it does not take ages to convert a new house — a palace — into a den of filth and disease. Conditions may exist, and do actually exist, on open fields, on hillsides, in the interior of the country, as well as in cities, favorable to the production of disease.

3. It may be said, "I don't think much of your statistics; you can prove anything by figures."

This is an oft-repeated remark, but in our judgment may be easily answered. Statistics may be defined as the science or art of applying facts to the elucidation and demonstration of truth. It is the basis of social and political economy, and the only sure ground on which the truth or falsehood of theories can be brought to the test. Mere columns of figures may or may not be statistics. They form, in any case, a small part only of the illustration. Combination and deduction are required to give them full effect. We belong to that class of statists who have no particular fondness for figures, though we have a great fondness for facts. We use figures

as the representatives of facts, not fiction, — of truth, not falsehood, — and find them very convenient for that purpose. We find it very difficult to prove or disprove many propositions without them. We are aware that some persons have a great antipathy to facts and statistics; but in this "matter-of-fact age" they are required; and they are far more useful and important than the fiction and theory, the assumption and assertion, that have occupied so much of public attention. We would follow, in estimating human life and human health, in all their various departments, bearings, and relations, the same course that judicious men pursue in other matters.

The state and condition, the statistics of a country, can be known only by gathering together the facts as to its movements and progress; and the statesman looks at the figures which represent these facts, and combines and deduces the truths they contain, for his guidance.

It is not often that the judicious merchant or other business man guesses, estimates, or theorizes on this or that kind of business, on this or that man's account, on his own profit and loss, or on his own pecuniary sanitary condition; but he goes to the statistics of his business, the records of his progress, his books; and he values and is guided by the definite facts thus disclosed. So we prefer a definite fact, even if it appear as a statistical truth, and represented by figures, to uncertain theory or vague speculation and assumption.

It would be easy to illustrate, almost indefinitely, these general remarks, and to show the advantage and absolute necessity of this mode of presenting truth, but we deem it unnecessary.

4. It may be said, "This measure will interfere with private matters. If a child is born, if a marriage takes place, or if a person dies, in my house, it is my own affair; what business is it to the public? If the person die at one age or at another, if he die of one disease or of another, contagious or not contagious, it's my business, not another's, — these are private matters."

Men who object and reason in this manner have very inadequate conceptions of the obligations they owe to themselves or to others. No family, — no person liveth to himself alone. Every

person has a direct or indirect interest in every other person. We are social beings, bound together by indissoluble ties. Every birth, every marriage, and every death, which takes place, has an influence somewhere; it may not be upon you or me now; but it has upon some others, and may hereafter have upon us. In the revolutions of human life it is impossible to foretell which shall prosper, this or that, — whether I shall be a pauper or have to contribute to support my neighbor, as a pauper, — whether I shall inherit his property or he inherit mine; and every person should be willing, and even desirous, to place within the reach of every other person, the fact that he has existed, and the means of identification. This is the common right which the public should claim of everyone, and the common privilege which everyone should have in all others.

5. It may be said, "This measure will interfere with private rights. If I own an estate hav'n't I a right to do with it as I please? to build upon it any kind of house, or to occupy it in any way, without the public interference? Hav'n't I a right to create or continue a nuisance — to allow disease of any kind on my own premises, without accountability to others?"

Different men reason differently, in justification of themselves, on this matter. One man owns real estate in an unhealthy locality; and if its condition were known, it might affect its value. Another has a dwelling-house unfit for the residence of human beings; and he will oppose any efforts to improve it because it will cost money, and he can have tenants in its present condition. Another does business in a place where, and at a time when, an epidemic prevails; and his occupation may tend to increase it; and, if these facts were known, it might affect his profits. These and similar reasons may lead different minds to oppose this measure. How extensively such opinions prevail we will not attempt to state. Some twelve years since one of this commission introduced into the city council of Boston an order of inquiry relating to a certain locality supposed to be unhealthy; but it was strongly opposed, because, as was stated, it would impair the value of the real estate in the neighborhood! There may be individuals who place dollars and cents, even in small amounts,

by the side of human health and human life, in their estimate of value, and strike a balance in favor of the former; but it is to be hoped that the number of such persons is not large.

6. It may be said, "Your measure will create an unnecessary expense; the state already spends too much money; we cannot afford it."

Everyone should reflect that this is not an expense, but an investment — a saving — a "stitch in time," which is designed to add to the wealth and not to the poverty of the Commonwealth; and such we have proved will be the result. Expenditures for celebrations, and for various temporary or other purposes, and of doubtful expediency, more than sufficient for this purpose, are often made within this state, without opposition and without counting the cost; and why should the trifling outlay for this most useful measure be urged to defeat it? But we have already demonstrated the economy of the measure, and we deem it useless to reply further to such as may still persist in making this objection.

7. It may be said, "If you diffuse information on these matters generally among the people, will you not make every person his own physician? will you not increase, and not suppress quackery; and thus magnify and not diminish the sanitary evils which it is your purpose to prevent?"

It seems to us that this measure will have an effect directly opposite to the one here supposed. It is not intended, in the least degree, to usurp or to interfere with the duties of the physician, in the cure of disease, but to aid him in his professional efforts, and to dignify the importance of those efforts. It is, however, intended to teach the people so much of their physical organization, and so much of the influences that act upon them, that they may know, and be led to avoid, the causes of disease, and thus escape the infirmities, the sufferings, and the consequences of sickness. This measure will teach the people to obtain proper medical advice when they are sick, and not to tamper with themselves or with their diseases, by unsuitable or dangerous remedies, nostrums or drugs, ignorant of their applicability to their own particular cases. It will lead them to understand when, or in what

stage of the disease, it is best to obtain professional advice; from whom to obtain it; and to discriminate between the good and the bad. Ignorance permits a cause of disease to operate unchecked until the disease itself actually invades the system; and the same ignorance permits the disease to make such advances before advice is obtained, that it is often impossible to arrest it. Intelligence, on the other hand, understands and avoids the causes of disease; or if disease should happen to have made its attack, the same intelligence will require medical advice of the proper kind at the commencement of the disease, when advice is most useful, and when the power of medical remedies is most decisive. And this intelligence will preside over all the domestic management of the sick room; and thus second all the efforts of the medical adviser, and give all possible effect to the remedies used for the expulsion of the disease. Ignorance and assumption constitute the essence of quackery; intelligence, and a desire to do right, contemn it; and this measure is designed to prevent the former, and promote the latter.

8. It may be said, "If you say so much about health and disease you will excite the alarm of the people, and create more disease than you prevent. It is better to let a place that is unhealthy remain so, unimproved, than to alarm the people about it."

If a place is unhealthy, and on that account an improper place of residence, does not a feeling of common humanity require that it should be known? If people are on the brink of a dangerous precipice, shall they not be told of their danger? — shall they be permitted to pursue their course to destruction, for fear of exciting their alarm? Is not a knowledge of their condition their only safety? The objection, in our judgment, instead of being a reason for the rejection of this measure, is a powerful one for its approval. "To be forewarned is to be forearmed." It is only those who know their capabilities and their liabilities, who know their dangers and means of removal or escape, that are confident and unalarmed. The ignorant, unconscious of the means of mitigation, are more likely to be timid, alarmed, and to be overpowered with groundless fears, on the approach of danger.

9. It may be said, "It will interfere with Divine Providence." "It was to be so." "It was so ordered." "If we are to die of cholera, typhus, consumption, or any other disease, it must be so,—it is useless and improper for us to interfere."

This is an old sentiment. It has formed a part of religious belief in different nations, from remote antiquity to the present time. Death, whether it come in the shape of a plague, mowing down its thousands, or as a solitary messenger, slowly wasting or suddenly destroying the individual, has been considered by many as the special Providence of God, with which we ought not and cannot interfere. As late as 1720, when inoculation for the smallpox, as a protection against the disease in the natural way, was introduced into Boston, it was strongly opposed; and one reason given was that it would interfere with this Providence. And even in our day some consider it a disobedience to a Divine command, "in sorrow thou shalt bring forth," to inhale ether or any other agent to mitigate pain, or to alter the character of labor!

We shall not attempt a discussion of any theological or philosophical question relating to the providential agency manifested by the Supreme Governor of all things, in presiding over and governing the universe which He has made; but we would view this great matter of life and health in the same light that we view all other matters with which they are connected, and over which this providential agency is extended. Could we see clearly the operation of cause and effect, we should see wise laws wisely administered in every event that takes place in the universe.

Pain, suffering, and the various physical evils to which we are exposed, may not seem to be a necessary part of the scheme of nature, but only as incidental to it. They result from the violations of her laws; and are permitted for wise purposes, perhaps for the discipline and development of our physical and moral powers. In the operation of epidemic diseases some innocent may suffer; but they are individual exceptions to the general rule; and they come like drought or blight upon the labors of the honest husbandman. It is easy to perceive that the sources of many, even a vast majority of these evils, may be removed by those who suffer from them; and that they do not lie so deep that human

agency cannot discover and destroy them. Man has a power to wield over and to expel disease. It has been asserted, by high authority, that "it would be possible to banish nearly all disease from the earth, and to restore man to his pristine vigor. If such a belief be true, that afflicting contrast between the sufferings of mankind, and the beauty and beneficent ordering of the universe, disappears. The source of the contrast is found to be within us, — the fountain of the evil is in ourselves."

10. It may be said, "We acknowledge that all you say is reasonable and cannot well be gainsaid; but we are a business-like, a money-making, and money-loving people. We are too much occupied to consider these matters. So many other things take up our attention that we hav'n't time to examine, much less to carry out your measure; our people are not up to it yet."

We are fully aware of the prevailing tendencies of the public mind, and of the indifference and apathy with which subjects relating to health are generally regarded. It is only in times when epidemic diseases prevail, or when we are reminded of their effects by our own sufferings or losses, that we are excited and interested. We are too much inclined to consider health as a matter "belonging to the doctors and not to us," and to depend upon them for a supply; that money is best obtained and time is best employed, when the dollar is sought, and desire is gratified, without regard to the sanitary consequences of any particular mode of doing it. Some strange anomalies and inconsistencies are found in society as at present constituted.

"Money-loving!" And is this the only object of life? Are there none that overlie it? And even if it be uppermost, are we pursuing the best means to obtain it? It is true that most of us, when selecting an occupation, a place of business, a place of residence, do not inquire into its sanitary influences, as we should do if we acted wisely: if it promises money we enter into it generally with characteristic zeal, regardless of the consequences. But how often do we have to learn that we committed an error! Instead of gradually accumulating capital, while preserving and invigorating our health, in a way which would give us a more prosperous, a happier and longer life, we make a hazardous speculation and lose

the whole. This is the result of ignorance. It is worse than that. It is folly and crime thus to rush recklessly into a sea of uncertainty, when safety and competence are certainly attainable otherwise.

"We hav'n't time!" Indeed! but we have time for other things, — for labor, for leisure, for dissipation, for almost anything we desire to pursue. And to what purpose more useful than the preservation of our lives and health can we devote a portion of our time? If time is not taken by us, and used by us, for this object, it will be taken by another agent; and we shall be prematurely deprived of an opportunity of using it ourselves for any purpose whatever. A shortened life and a debilitated frame will be the consequence of ignorance and inattention; a lengthened life and an invigorated constitution, of knowledge and application. In plain English, we have no time means we have no disposition. If we have a disposition to examine and carry out this measure we shall find time and ability to do it, and still have enough for other purposes. "Where there is a will there is a way"; where there is a disposition there is a time, — "a time for all things."

The younger portion of society may be taught the lessons of experience which the elder portions have learned during a long life, — the physical calamities to which they have been exposed, the mistakes they have made, and the remedies of reparation they have used. They may be told the best course to pursue to invigorate and prolong their own existence. But how few apply this instruction as a guide to their own advancement in physical improvement! How great a proportion say, "it will do well enough for old people to talk so, but we are well enough as we are, we live in another age"; and they thus neglect and refuse to apply the useful instruction of others, and wait until taught by their own sad experience. They are then often too old to profit by it. They did not learn how to live, until their lifetime had nearly expired.

Here we might rest our labors; but we cannot close our report without a few words of appeal which our subject suggests.

1. It appeals to physicians. "The members of our profession," says an eminent medical authority, "who have already

embarked in this most righteous crusade against physical corruption, cannot but feel themselves encouraged and supported by the sympathy and co-operation of the clergy; and those who have not yet taken any part in furtherance of the sanitary cause may perhaps find a motive to exertion in the growing interest with which it is regarded by the members of other professions, and by society at large. But a sense of duty, far more than the mere force of example, ought to enlist the medical man in this holy warfare. No member of society is so cognizant as he is of the facts of the case, or better prepared to interpret and enforce them; no one is less open to the suspicion of mean or unworthy motives; and no one has such frequent opportunities of converse with men of every rank and degree.

2. It appeals to clergymen. Their official duties lead them to visit the sick and the dying; and they should be forcibly impressed with the truth that the architect and the scavenger, — that sanitary reforms in their various modes of operation, — are their best colleagues. They should see and feel, that removing physical suffering and raising the social and personal condition of the sufferer is the surest way of gaining access to the heart, and of making their warnings, their instructions, and their consolations effectual; that the easiest and most permanent impressions are those made before the body and the mind become degraded in filth, stupefied by disease, or hardened and seared in guilt. In their personal intercourse and in their preaching, they should diffuse sanitary information, and urge the importance of sanitary measures. A weighty responsibility rests upon such men, and it becomes them to feel it, and to make themselves perfect masters of the subject, that they may use the information wisely and usefully in helping forward one of the greatest reforms of the age.

3. It appeals to educated men of all classes. As a matter of intense interest, as a matter requiring profound investigation, as a matter of useful science, few subjects can be presented to an intelligent mind which promises more satisfactory results than the sanitary movement. For these objects alone it is worthy of being studied. But when it is viewed, in its personal and social relations to man and mind, it, in many respects, transcends all other mat-

ters. To those, who, by education, are qualified for the labor, few objects present a greater or more extended field of usefulness. Educated men and educated women too, who make themselves masters of sanitary science, may, by their pens, by their oratory, and by their personal influence, do an amount of good of which few or any of us have as yet an adequate conception. Such labors, judiciously conducted, would exert a mighty influence on the happiness of the race and its unborn millions. On such persons also rests a great responsibility.

4. It appeals to the wealthy and philanthropic. The munificent charities of the people of Massachusetts are well known. Many a one has given living or testamentary evidence that there runs through our society a strong current of social sympathy, and a willingness and even a desire to dispose of portions of the wealth, which has been bestowed upon us, for the relief and elevation of suffering humanity. Among the different objects which present themselves for these noble sympathies, we solicit for the sanitary movement a careful examination. In our judgment no object is of more paramount interest and importance. Money used in collecting and diffusing sanitary information; in the establishment and maintenance of institutions designed to prevent sanitary evils; and in the various modes of operation which may be devised and carried forward by energetic and wise men, would prevent an amount of evil, and would accomplish an amount of good, promised by few or no other means.

5. It appeals to the people. This measure is, unlike many others, limited in its design and local or partial in its application. It reaches, and is intended to reach, every person in every part of the state. If adopted and properly carried into operation it will be universally felt,—by the professional man, the artisan, and the laborer, by the rich and the poor; and the general salutary effects will be gradual but perceptible and great, upon the collective interests of the whole state, and upon the social and personal interests of each individual. Every man in every station has a direct interest in its success; and everyone should do all in his power to establish and make it successful. Everyone should, as far as possible, endeavor to understand the character and design

of the measure, and should commend its principles to others; he should unite in forming local sanitary associations; and in obtaining the passage of wise sanitary laws and regulations, and he should assist the public authorities in carrying them into operation. Every person should endeavor to reform whatever sanitary evils may exist in his own person and habits, and those of his family and neighborhood. And by these means the sanitary movement will be accelerated, and sooner accomplish the high and noble purposes for which it is destined.

The sanitary reform we advocate is not like some of the popular reforms of the age. It rests upon no visionary theories, conceived alone in the closet, or by some impracticable enthusiast. It aims at the establishment of no abstract principle, with no definite, practical bearing or application. It is not radical in its character or tendency; does not seek to overturn nor upturn any social, political or religious sentiment or institution; nor abrogate any constitutional or statute law. It interferes with no man's rights, — pecuniary, social, political or religious. But it takes things as they are; looks upon man as it finds him; allows him to enjoy the institutions with which he is favored; and gives him the means of living longer, and of enjoying more while he does live. There is in this no transcendentalism, or other ism or ology, to which any reasonable objection can be made; though it transcends, in its simplicity, in its practical utility, and its substantial, everyday, universal benefits, all other reforms. Every person, in every station, can do something to promote this reform; and every such effort, wisely directed, will increase the amount of his own individual enjoyment, and add to the aggregate enjoyment of the people of the whole Commonwealth.

6. It appeals to the periodical press. In this country almost every adult reads. Indulgence in the luxury of a newspaper is a universal characteristic of our people; and by the power of steam the press is able to furnish this luxury in an unprecedented manner and in any desirable quantity. We have watched with admiration, but not without fear, the growth and influence of the mighty power of the free periodical press. It educates, sways, shapes, and carries backward or forward, many an individual, and often the

public, too, in a career of infamy or in a career of glory. It assumes an immense responsibility; and every press should feel it, and wield its influence for good and not for evil.

7. It appeals to towns and cities. On the municipal authorities of towns and cities depends the immediate execution of all sanitary laws and regulations. They are required to perform an important duty. Thorough knowledge of the condition of the people, and wise adaptation and administration of sanitary measures, will benefit and bless them. But blundering ignorance, or inconsiderate measures, or unwise administration, will not do it. Life, health, physical happiness, and even the moral condition of a town, may depend, in some degree, upon the adoption or rejection of proper sanitary regulations. An immense responsibility then rests upon these local authorities.

8. It appeals to the state. Under our constitution and laws "each individual in society has a right to be protected in the enjoyment of his life." This may be considered in a sanitary as well as a murderous sense. And it is the duty of the state to extend over the people its guardian care, that those who cannot or will not protect themselves may nevertheless be protected; and that those who can and desire to do it may have the means of doing it more easily. This right and authority should be exercised by wise laws, wisely administered; and when this is neglected the state should be held answerable for the consequences of this neglect. If legislators and public officers knew the number of lives unnecessarily destroyed, and the suffering unnecessarily occasioned by a wrong movement, or by no movement at all, this great matter would be more carefully studied, and errors would not be so frequently committed.

Massachusetts has always been eminent among the American states. Her metropolis has ever been the metropolis of New England. Her example has been imitated and her influence has been felt, wherever the sons of New England are found, or the name of New England is known. Her deeds are such as to justify even her own sons for an allusion to them.

Her puritan forefathers established the first system of self-government, combining law and order with liberty and equality,

and based upon pure morality, universal education and freedom in religious opinion, as the only foundation which can insure its permanency and prosperity. And in her cradle was rocked the first child that drew its first breath under its benign influence.

She has her Concord, her Lexington, and her Bunker Hill, all marked as the first battle-fields in that great struggle which severed the children from the parent, and made them free; into their soil was poured the blood of the most worthy and the most noble patriots the world has ever known; and " the bones of her sons, falling in the great struggle for independence, now lie mingled with the soil of every state from New England to Georgia, and there they will lie forever."

She established, more than two hundred years ago, and near the beginning of her existence, free schools, open alike to all; and they have been cherished and supported, from that time to the present, by money drawn from the treasuries of towns, replenished by taxes on the inhabitants. She expended in this way, last year, for these free schools, $830,577.33, — a sum equal to $3.87 for every child in the state between the ages of four and sixteen. The whole state has been dotted over with schoolhouses, like "sparkling diamonds in the heavens," giving intellectual light to all that come within their sphere.

She established in the United States the first system for the public registration of births, marriages, and deaths, by which the personal history and identity, and the sanitary condition of the inhabitants, may be ascertained. She founded the first Blind Asylum; the first State Reform School; and aided in founding the first Deaf and Dumb Asylum; and her money, public and private, has flowed freely in the support of all the noble charities and religious enterprises of the age.

One of her sons first introduced into the United States the remedy of vaccination for the prevention of smallpox, which has deprived that terrific disease of its power, whenever used, and rendered its approach generally harmless. Another of her sons has the honor of making the great discovery of etherization, by means of whose wonderful capabilities the surgeon's instrument is deprived of its sting, and labor of its sorrow; the operator is per-

mitted to pursue his work undisturbed, while the patient remains passive, unconscious, and unmoved by the horrors which, without it, might be inflicted. The blessings of this great prevention of human suffering are already acknowledged and felt the world over.

For these and very many other useful and honorable deeds, which might be specified, she has been named, by distinguished men of other states and countries, " the forefather's land," " the moral state," " the enlightened state," " the patriotic state," "the philanthropic state," "the leading state," "the pattern state," "the noble state," "the glorious old Bay state." And many an ejaculation has gone up in all sincerity, " God bless her"; " God save the Commonwealth of Massachusetts! "

"There she stands"; a bright morning star in the system of the Union. On the pages of her history are recorded the noble deeds which have given her a good name and rendered her glorious. But her people demand at her hands a more full enjoyment of life, and a more abundant diffusion of its blessings; and no more noble and honorable and glorious page can anywhere be found, than that which shall record the adoption of some simple but efficient and comprehensive plan of Sanitary Reform; by which the greatest possible amount of physical power may be produced, the greatest possible amount of physical suffering may be prevented, and the greatest possible amount of physical, social, and moral enjoyment may be attained. " This is the true glory which outlives all other, and shines with undying lustre, from generation to generation, imparting to its works something of its own immortality."

All which is respectfully submitted.

LEMUEL SHATTUCK,
N. P. BANKS, JR.,
JEHIEL ABBOTT,
Commissioners.

BOSTON, April 25, 1850.

CHAPTER XXI

APPENDIX TO SANITARY REPORT

I. Titles of Acts relating to Public Health, passed by the State of Massachusetts

1692. An Act for Prevention of Common Nuisances arising by Slaughter-houses, Still-houses, etc., Tallow-chandlers, and Curriers. *Act and Laws of Province of Massachusetts Bay.* Ed. 1759 and 1771, p. 15.

1696. Chap. 6. An Act in addition to an Act for Preventing of Common Nuisances arising from Slaughter-houses, Still-houses, etc., p. 68.

1700. An Act directing the Admission of Town Inhabitants, p. 125.

1701. An Act providing in case of Sickness, p. 135. Repealed, 1797.

1702. An Act for appointing Commissions of Sewers, p. 142. Repealed, 1796.

1708. An Act in addition to and explanation of the Act for Prevention of Common Nuisances, p. 158.

1709. An Act for Regulating of Drains and Common Shores, p. 161. Repealed, 1796.

1710. An Act explaining and enlarging of the Act for Prevention of Common Nuisances arising by Slaughter-houses, Still-houses, etc., Tallow-chandlers and Curriers, p. 166.

1730. An Act empowering Courts to adjourn and remove from the Towns appointed by Law for holding Courts to other Towns, in case of Sickness by Smallpox, p. 265. Repealed, 1797.

1742. An Act to prevent the spreading of Smallpox and other Infectious Sickness and to prevent the concealing the same. Repealed, 1797.

1744. An Act in addition to an Act for Regulating Drains and Common Shores. Repealed, 1796.

1750. An Act to regulate the Importation of German and other Passengers come to settle in the Province, p. 342.

1751. An Act in addition to an Act made and passed in the thirteenth year of King William the Third, entitled An Act providing in Case of Sickness, p. 356. Repealed, 1797.

1757. An Act for Regulating the Hospital on Rainsford's-Island, and further providing in Case of Sickness, p. 375. Repealed, 1797.

1758. An Act in addition to an Act entitled An Act for Regulating the Hospital on Rainsford's-Island, and further providing in Case of Sickness, p. 378. Repealed, 1797.

1763. An Act in addition to an Act relating to Common Sewers. Repealed, 1797.

1776. An Act to prevent the Continuance of the Smallpox in the town of Boston, and to license inoculation there for a limited time. Repealed, 1792.

1776. An Act empowering Justices of the Court of General Sessions of the Peace in the several Counties to permit inoculating Hospitals to be erected in said Counties. Repealed, 1792.

1777. An Act in addition to the above Act. Repealed, 1792.

1785. March 8. An Act against selling unwholesome Provisions, vol. i, p. 224. Repealed, 1836.

1785. June 7. An Act for preventing Common Nuisances. *Laws*, Ed. 1801, vol. i, p. 241. Repealed, 1836.

1787. Feb. 28. An Act for the due Regulation of Licensed Houses, p. 374. Repealed.

1788. March 26. An Act for suppressing and punishing of Rogues, Vagabonds, Common Beggars, and other idle, disorderly and lewd Persons, p. 411. Repealed, 1834. *Laws*, 1834, p. 206.

1792. An Act providing for the establishment of Hospitals for inoculating with the Smallpox, and for repealing all laws heretofore made for that Purpose. Repealed, 1793.

1793. March 15. An Act providing Hospitals for Inoculation, and for preventing Infection from the Smallpox, and for repealing several Acts heretofore made for that Purpose. *Laws*, vol. ii. Repealed, 1836.

1796. Feb. 26. An Act for appointing Commissioners of Sewers, and making Provision for the better Improvement of Low Lands in Certain Cases, vol. ii, p. 721. Repealed, 1836.

1797. Feb. 20. An Act for regulating Drains and Common Sewers, vol. ii, p. 752. Repealed, 1836.

1797. June 22. An Act to prevent the spreading of contagious Sickness, vol. ii, p. 788. Repealed, 1836.

1798. Feb. 27. An Act in addition to an Act, entitled " An Act for Suppressing Rogues, Vagabonds, Common Beggars, and other idle, disorderly and lewd Persons," vol. ii, p. 812. Repealed, 1834.

1799. Feb. 13. An Act to empower the Inhabitants of the Town of Boston to choose a Board of Health, and for removing and preventing Nuisances in said Town, vol. ii, p. 837. Repealed, June 20, 1799.

1799. June 20. An Act to empower the Town of Boston to choose a Board of Health, and for removing and preventing Nuisances, vol. ii, p. 867.

1799. June 21. An Act to empower the Inhabitants of the Town of Salem to choose a Board of Health and for removing and preventing Nuisances in said Town, vol. ii, p. 879.

1800. Feb. 26. An Act in addition to an Act, entitled, "An Act to prevent the spreading of contagious Sickness," vol. ii, p. 896. Repealed, 1836.

1800. March 4. An Act in addition to an Act, entitled, " An Act to prevent Common Nuisances," vol. ii, p. 921. Repealed, 1836.

1800. June 16. An Act in addition to an Act, entitled, " An Act to empower the Inhabitants of the Town of Salem to choose a Board of Health, and for removing and preventing Nuisances in said Town "; and for repealing Part of said Act, vol. ii, p. 939.

1802. Feb. 22. An Act to empower the Inhabitants of the Town of Marblehead to choose a Board of Health, and for removing and preventing Nuisances in said Town, vol. iii, p. 44.

1803. June 18. An Act in addition to an Act, entitled, "An Act to empower the Town of Boston to choose a Board of Health, and for removing and preventing Nuisances," vol. iii, p. 161.

1804. March 7. An Act to repeal a part of an Act, entitled, "An Act to empower the Town of Boston to choose a Board of Health, and for removing and preventing Nuisances," and for making further Additions thereto, vol. iii, p. 218.

1809. June 16. An Act in further addition to an Act entitled, "An Act to entitle the Town of Boston to choose a Board of Health, and for removing and preventing Nuisances." *Session Laws*, 1809, p. 11.

1810. Feb. 27. An Act to empower the Inhabitants of the Town of Plymouth to choose a Board of Health, and for removing and preventing Nuisances in said Town. *Ibid.*, 1810, p. 89.

1810. March 6. An Act to diffuse the Benefits of Inoculation for the Cow Pox. *Ibid.*, p. 204. Repealed, 1836.

1810. March 6. An Act in further addition to an Act entitled, "An Act to empower the Town of Boston to choose a Board of Health, and for preventing and removing Nuisances." *Ibid.*, p. 221.

1816. June 20. An Act to empower the Town of Boston to choose a Board of Health, and to prescribe their power and duty. *Ibid.*, 1816, p. 258.

1818. June 12. An Act authorizing the Town of Charlestown to establish a Board of Health. *Ibid.*, 1818, p. 14.

1821. June 16. An Act to empower the Inhabitants of the Town of Lynn to appoint a Board of Health and for removing and preventing Nuisances in said Town. *Ibid.*, 1821, p. 588.

1822. Feb. 23. An Act to establish the City of Boston. *Ibid.*, 1822, p. 734.

1827. March 2. An Act authorizing the Town of Cambridge to establish a Board of Health. *Ibid.*, 1827, p. 473.

1835. Nov. 4, 1835. *Revised Statutes.*—Went into operation, April 30, 1836.

Chap. 21. On the preservation of the public health; quarantine; nuisances; and offensive trades. *Ibid.*, pp. 207–214.

Chap. 131. Of offences against the public health. *Ibid.*, p. 742.

1837. April 20. An Act relating to Alien Passengers.

1837. April 20. An Act concerning the Public Health. *Sup. Rev. Stat.*, p. 58.

1838. April 20. An Act to repeal certain Provisions of Law in relation to the Smallpox. *Ibid.*, p. 82.

1840. March 18. An Act concerning the Smallpox. *Ibid.*, p. 149.

1841. March 17. An Act in relation to main Drains and Common Sewers. *Ibid.*, p. 196.

1842. March 3. An Act relating to the Registry and Returns of Births, Marriages, and Deaths. *Ibid.*, p. 240.

1844. March 16. An Act relating to the Registry and Returns of Births, Marriages, and Deaths. *Ibid.*, p. 308.

1848. April 18. An Act to repeal certain Provisions of Law in Relation to the Smallpox. *Ibid.*, p. 451.

1848. May 10. An Act concerning Alien Passengers.

1849. May 2. An Act in relation to the Public Health. *Ibid.*, p. 549.

1849. May 2. An Act relating to the Registration of Births, Marriages, and Deaths. *Ibid.*, p. 545.

1850. March 20. An Act relating to Alien Passengers. *Session Laws. Ibid.*, pp. 338 and 467.

1850. March 21. An Act in addition to an Act relating to the Public Health. *Ibid.*, p. 341.

Statutes of the United States relating to Health

1799. Feb. 25. An Act respecting Quarantine and Health Laws. *U. S. Statutes*, Little & Brown's ed., vol. i, p. 619.

1819. March 2. An Act regulating Passenger Ships and Vessels. *Ibid.*, vol. iii, p. 488.

1847. Feb. 22. An Act to regulate the Carriage of Passengers in Merchant Vessels. *Ibid.*, vol. vi, p. 127.

1848. May 17. An Act to provide for the Ventilation of Passenger Vessels and for other purposes. *Ibid.*, vol. vi, p. 220.

1848. June 26. An Act to prevent the importation of Adulterated and Spurious Drugs and Medicines. *Ibid.*, vol. vi, p. 237.

Correspondence with the Medical Society

Boston, Oct. 1, 1849.

To the Councillors of the Massachusetts Medical Society:

Gentlemen, — Commissioners have been appointed by the State, under a resolve of the Legislature, passed May 2, 1849, " to prepare and report to the next General Court, a plan for a sanitary survey of the State, embracing a statement of such facts and suggestions as they may think proper to illustrate the subject"; and they desire to avail themselves of all the information within their power to obtain in relation to the object of their appointment. They would feel themselves under special obligations to the Councillors of the Massachusetts Medical Society —

First, for any suggestions as to the objects of such a survey;

Second, as to a plan by which these objects may be accomplished; and

Third, for any facts or statements which may illustrate the subject.

Among other matters, the Commissioners desire to present, in their report, a systematic nomenclature of diseases and causes of death, which shall meet general approbation, and serve as a simple classification for sanitary and statistical purposes; and as a standard of comparison of the different parts of the State with each other and with other places. In the enclosure is a report of a plan recommended by the National Medical Convention, at Philadelphia, in 1847. This nomenclature was prepared on the basis of that used by the Registrar General of Births, Marriages and Deaths, in England, and is fully explained in his Fourth and Seventh Annual Reports. We would thank you to inform us how far it meets your approbation, and what alterations, if any, you would propose.

In behalf of the Commissioners,

I am, with great respect, your obedient servant,

Lemuel Shattuck, *Chairman.*

A letter of a similar purport was addressed to the Consulting Physicians of the city of Boston. The replies are subjoined:

BOSTON, Oct. 9, 1849.

To LEMUEL SHATTUCK, Esq., *Chairman of the Sanitary Commission:*

SIR, — In conformity with your request, I have laid before the Board of Consulting Physicians of the city of Boston, your communication on the subject of a sanitary survey of the State. The Board having been informed that the Councillors of the Massachusetts Medical Society have appointed a committee, who will probably make a laborious investigation of the subject, have thought it best to propose to that committee to see the results of their labors, to which they will either give their approval, or will invite a conference on such points as it might be useful to discuss.

Respectfully, your obedient servant,

J. C. WARREN.

To LEMUEL SHATTUCK, Esq., *Chairman of the Board of Commissioners on a Plan for a Sanitary Survey of the State:*

SIR, — Your communication of the date of October 1st, addressed to the Councillors of the Massachusetts Medical Society, and asking their advice in respect to the proposed sanitary survey, was received on the 3d, and then referred by the Councillors to the undersigned, as a committee for consideration and answer.

The commissioners, being appointed to furnish a plan of a sanitary survey merely, have limited their inquiries of the Medical Society to three points. They only ask to be advised as to —

The objects of the proposed sanitary survey,

The plan by which the survey shall be conducted,

And some facts which may serve to show the practicability and usefulness of the survey.

The objects of the sanitary survey, and some of the reasons which should influence the Legislature in authorizing it, have been stated at considerable length in two memorials which have been presented to the Legislature, — one in 1848, by the American Statistical Association, printed as House document No. 16, of that year, and the other by the Massachusetts Medical Society in 1849, and printed as House document No. 66, of that year.

It is the object of the proposed survey to ascertain the hygienic resources and influences of the State;

To know the amount of vitality, of life and health enjoyed by the people of this Commonwealth;

To learn whether there are any differences in regard to life and health among our people, and what those differences are.

Even without inquiry, it is manifest that the health, strength, and length of life differ very widely in different persons.

And it is suspected, though not demonstrated, that these differences exist in regard to whole communities living in different places or regions, and in regard to different classes living together.

It is, then, to remove or to confirm this last suspicion that the sanitary survey is asked to inquire —

Whether there are differences of vitality — of life and health, among the people in the different parts and classes of the State;

In the interior and on the seacoast;

In the eastern counties exposed to the east winds, and in the western counties, which are protected by the high lands from these winds;

In the high and mountainous districts, and in the lower and level towns;

In the dry and level towns, and in those which are low and marshy, as in the valley of the Concord River;

On the borders of ponds and streams which vary but seldom in fulness, and on the borders of artificial mill-ponds and streams that are interrupted by dams, and which, varying constantly in fulness, leave their muddy margins bare for the exhalation of vapors, perhaps of miasmas;

In the dense cities and in the open country, with pure air;

In houses that are well ventilated, and those that are crowded with occupants and without the means of obtaining pure air for respiration.

The survey proposes to ascertain, whether there are differences of vitality in the various kinds of occupation, —

Among those engaged in agriculture, in manufactures, in the mechanic arts, in navigation, trade and commerce, the learned professions, etc.

There may be differences of life and health in different domestic conditions, of prosperity and adversity, of wealth and poverty.

The tone of health may be higher or lower and the length of life greater or less among families whose dwellings are variously situated, on dry or wet sites; on natural or on artifical land; in the vicinity of, or at a distance from, the seats of decomposing animal or vegetable matters, as burial-grounds, cemeteries, slaughter-houses, barn-yards, cesspools, depositories of offal, manufactories of glue, leather or chemicals, laboratories, etc.

These differences of locality, circumstance, and condition, suggest themselves to the undersigned as worthy of investigation in regard to their sanitary influences. But they are not all; more might be mentioned, and the progress of the survey will probably discover many others that have not been exposed or even suspected.

In those countries where such a sanitary survey has been made, life and health are found to be different in their various localities, circumstances and conditions; and in some of them these differences are very great.

Some partial inquiries, and the general belief of those who are most familiar with sickness and suffering, afford good ground for the suspicion that similar differences exist here; and it is important for the people to know whether it is so or not, and to what extent.

The facts of health and sickness, of life and mortality, can be ascertained by the sanitary survey as certainly and as easily as the various conditions of agriculture were by the agricultural survey, which have been effected by the authority of the Legislature and laid before the people of the Commonwealth in the admirable reports of Mr. Colman; or as the various kinds of animal

and vegetable productions, and mineral resources, which the Commission of Natural History examined and published in their valuable reports.

Wherever differences of vitality are found to exist in connection with difference of circumstance, condition, locality, or manner of life, it may be assumed as probable, at least, if not certain, that the former are the consequences of the latter.

It is an unquestionable principle, that, in the operations of life as well as in those of dead matter, there is no event without a cause adequate to produce it.

It is equally certain, that in life as well as in death, in similar circumstances and conditions, like causes produce like results. In this law of vital action, there is no uncertainty nor variableness. There is no more caprice or mystery in the flow and ebb of life, in the maintenance of health, in the cause of sickness or in the event of death, than there is in the flow and the ebb of the tides, in the movements of the stars, or in the action of gravitation.

It must be admitted as a universal fact, that, from any definite amount of vitalizing or destructive influence acting upon living beings, there will follow a definite and corresponding amount of health, strength and life, or of sickness, weakness and death. Between the amount of the cause and the amount of the effect there is an exact relation. No matter how weak or how powerful may be the deteriorating cause, precisely corresponding to that will be the deterioration. It may be so slight as to escape notice, and therefore seem not to follow; it may be only a little impediment to the vital processes, a little indisposition to think or act, or some headache or oppression at the stomach; or it may be a fever or dysentery, or other disease of greater or less severity, which may result in the extinction of life; but in no case does it fail to grow out of, and to correspond with, the vitiating influence that has acted or is acting upon the human constitution.

Whatever may be these differences of fulness and energy of the vital actions, in individuals or in classes, or in whole communities living in various localities, they are produced by some causes connected with those individuals, classes, or communities; by something in their organization, in the circumstances about them, the atmosphere they breathe, the supplies that are given to their natural wants, the privations they endure, the manner in which they are employed, or in the habits they indulge, which may be assumed as the causes of their diseases or the depression of life.

Wherever, then, the vital energies are depressed, or disease prevails, or life is shortened below the average of the experience of the people of the State, or of mankind, there it will be proper to inquire into the circumstances, conditions and habits of those who thus suffer, and ascertain the causes of their low health. And when these causes shall be made known, then the people may avail themselves of this information, and avoid those circumstances, conditions and habits, connected with which health is low and life is short, and betake themselves to those in which health is high and life is long, or modify them in such a manner as to make them not only not injurious, but, on the other hand, beneficial.

It is not to be assumed here, that either science or popular observation has demonstrated the connection between disease and its cause. In many, per-

haps in most cases, these causes have baffled the acutest investigation. Sometimes, without any discernible difference of circumstances, conditions or habits, some persons are sickened and others remain well. In others, there seem to be sufficient causes in their peculiarities of circumstance, condition or habits, but yet the connection between these peculiarities and the consequent or coexisting bodily ailments has thus far been so subtle as to elude the eye of human observation.

But in many other cases, these causes are sufficiently tangible and palpable to encourage investigation, with some, perhaps with satisfactory success. At the very least, the sanitary survey can reduce the number of probable causes to the number of distinguishing peculiarities of person and circumstance, out of which science may be able to select the true and efficient cause of disease.

If it should be found, that there is more mortality in the early and middle periods of life, and especially in infancy, or if certain diseases of the endemic, epidemic and contagious class, are shown to be more prevalent in cities than in the open country, then it will be reasonably supposed, that density of population, or some of the circumstances connected with it, are less favorable to the development and the maintenance of life than the scattered condition of rural districts.

If in certain localities, or occupations, or classes of people, certain diseases are more frequent and fatal than in others, then it will be natural to look for some cause connected with these localities, occupations or classes, that produce these differences of disease and death.

The mortality from consumption, in Massachusetts, during the last four registered years, was 57 per cent greater among females than among males; and in the state of New York, during the registered years of 1847 and 1848, this difference was 37 per cent against the females.[1] This excess of mortality from consumption must be charged to something connected with the organization, the condition, or the habits of the female sex.

These are mere specimens of the topics of inquiry. Many others might be mentioned, but they will readily occur to you, and many more will present themselves to the person or persons to whom the survey shall be entrusted while in the progress of the work.

[1] Deaths from consumption in Massachusetts, recorded in the Annual Registration Reports, for the years 1845, 1846, 1847 and 1848:—

Females,	5458
Males,	3476
Excess of females,	1982
Per cent of excess,	57

Deaths from consumption in the state of New York, according to the Registration Reports, for 1847 and 1848:—

Females,	3888
Males,	2825
Excess of females,	1063
Per cent of excess,	37

This investigation should be extended so as to reach all the varieties of locality, circumstances, employments, conditions and habits, of the people of this Commonwealth, and thus ascertain and show to the world how far each and all of these are favorable or unfavorable to the life and health of man.

The plan of the sanitary survey should include all the varieties of deterioration of human life, and all the varieties of circumstance, condition and locality, that may be suspected to be the causes of disease.

It is, therefore, more comprehensive than the plans of survey pursued in some other countries, where they were adopted for specific purposes and directed to specific objects.

In England, the Poor Law Commissioners, by order of the government, first established an inquiry into the sanitary condition of the laboring classes. This inquiry was conducted by Mr. Chadwick, the secretary of this commission. Afterward, the same board directed another inquiry into the practice and effect of interment in towns upon the health of the people. This investigation also was conducted by Mr. Chadwick.

Subsequently the government appointed a large and distinct commission to make an elaborate and minute inquiry into the health of towns.

Besides these, Parliament has caused several other inquiries, through other committees, to be made as to the condition and health of children and other operatives employed in factories, mines, etc.

All of these commissions pursued their investigations separately, and all of them called to their aid, wherever needed, the ablest men in the kingdom, and such as were engaged in such pursuits as made them familiar with the several objects of inquiry.

Each of these commissioners made large and exceedingly valuable reports, and revealed such a state of things, such an amount of degradation and low health, connected with removable causes, as few not familiar with these matters suspected to exist in any civilized nation.

In France, M. Villermé and Parent Duchatelet were directed to examine certain specific objects, as the condition of the supplies of water, drainage, etc., in Paris; the effect of slaughter-houses upon the health of the neighborhood, and of tobacco upon those who used or worked in it, etc.

Taking counsel of the experience of these nations, it now seems best, that all of these and other sanitary objects should be embraced in one plan and entrusted to one commission for investigation.

There are various ways in which this commission may be constituted.

As the Bank Commission, of which each member gives himself to the work.

As the Board of Education, who assume only general directing power and perform no labor. They elect a secretary on whom devolves all the work of the commission.

Or, as the Commission for the Trigonometrical Survey, or the Geological Survey, or the Natural History Survey, or the Agricultural Survey. By resolution of the Legislature, " the Governor was authorized and requested to appoint some suitable person or persons to make a thorough geological,

mineralogical, botanical and zoölogical survey of this Commonwealth under his direction." The Commissioners for the Trigonometrical and Agricultural Surveys were appointed in the same manner.

Of all these methods of constituting the proposed commission, the second and third alone seem to be eligible. For all the labor will and ought to come upon one man, who must devote his whole mind exclusively to the work.

And of these two plans, the last is to be preferred, because this inquiry, like the geological and other natural history surveys, should be entrusted to the most competent person, who must pursue that course which his knowledge of the whole subject and his increasing experience point out to him as the best.

It is obvious that this is no small work. It cannot be accomplished without great and persevering labor, much travel to all parts of the State, much intercourse with the people, and often painful and disagreeable familiarity with the seats of disease, the abodes of poverty, privation and suffering, and the places of filth and noxious effluvia.

A wise and provident government would not limit the time that should be given to this great work; but it would leave it, as the former Legislatures left the trigonometrical and geological, and other surveys of kindred nature, in the hands of the proper commission until it should be entirely finished. For, doubtless, this survey of man's health will demonstrate, as the commissioners for the survey of minerals, vegetables and animals showed in regard to wealth, that " the resources developed uniformly seemed to increase in proportion to the minuteness and extent of the investigation." The farther and more minutely the inquiries shall be made, the more differences of life and health may be discovered, and more varieties of locality, circumstance and condition, the probable or certain causes of vital deterioration will be exposed.

It would be easy to add numberless facts to illustrate the advantages of the proposed survey. They may be found in the English and the French reports in great abundance; and some few have been discovered by inquiries here.

It is not necessary to quote many at this time, yet there are some things to which the attention of the Legislature may now be very properly drawn.

There is a very common notion that the privations and discomforts of poverty are at least compensated by health. The robust strength of the laborer is often referred to as an example of this compensation. The children, especially of the poor, who are often neglected and uncleanly, in want of proper clothing, and exposed to the severity of the elements, are quoted as proofs of the uselessness of attending to many of the rules of health. But all inquiry into the condition and health of the poor shows the fallacy of these opinions and the evil consequences of following them.

Mr. Chadwick's Report on the Sanitary Condition of the Laboring Classes shows that, within the reach of his inquiry, the average age at death of all persons, including father, mother and children, in the families of the most prosperous classes was 42.6 years, and in the families of the poor only 20.4 years.

Among the prosperous only 20 per cent and among the poor 50 per cent, of the deaths, were of children under five years of age.

According to Benoiston du Chateauneuf, among 10,000 persons living at each age and in each class, in Paris, there died —

Age	Rich	Poor
30 to 40	108	157
40 to 50	117	213
50 to 60	199	359
60 to 70	360	750
70 to 80	804	1436

An analysis of the bills of mortality of the town of Dorchester for more than a quarter of a century showed, that those who had died within that period in the families of the poor had enjoyed an average longevity of only 27.4 years, while those who died in the families of the prosperous had lived, on an average, 45.6 years. Among the poor 31 per cent and among the prosperous only 12.4 per cent of all the deaths were of children under two years of age. Among the poor only 9 per cent, while among the rich 27 per cent lived to the age of three score and ten years.

Wherever this inquiry has been made a similar result has been obtained; the revelation of a lower degree of health and a shorter life among the poor, and a higher degree of health and a longer life among the more prosperous classes.

EDWARD JARVIS,
JOHN D. FISHER,
S. PARKMAN.
Committee of the Massachusetts Medical Society.

Boston, December 10, 1849.

CIRCULAR PREPARED BY THE COMMISSION, AND RECOMMENDED TO BE USED BY THE GENERAL BOARD OF HEALTH, IN SOLICITING INFORMATION CONCERNING THE SANITARY CONDITION OF THE STATE.

BOSTON,————— 18—.

To the Board of Health of

GENTLEMEN, — The General Board of Health are making investigations into the condition of the different parts of this Commonwealth, to ascertain the causes which affect the health of the inhabitants; and, for this purpose, they have addressed the following inquiries to the Local Boards of Health of the several cities and towns, and to some other persons. It is their desire that such an examination should be made as will secure the result they have in view. You are requested to undertake the investigation in your town. It is not expected that you will answer every inquiry: the information sought for by some of them is already in our possession. Some are of more importance than others; a few are applicable only to cities and populous places, and may not be to your town. Such as require your particular attention we have marked with a pen. The Board firmly believe that the importance of the subject to every person in the State, and to your town especially, will secure the hearty approval of every good citizen. They would suggest, as a preliminary step, the formation of a Town Sanitary Association, for the purpose of co-operating with you, by their aid and assistance, in obtaining the information.

The answers may be written on a separate sheet, and numbered with the same numbers as the inquiries to which they relate. Or a general description of the sanitary condition of the town may be given, embracing such of the topics suggested as may be applicable to that particular locality. If you can give any information in regard to the whole subject, or any matter connected with it, which might be material or useful as illustrations, even if it should not be elicited by the inquiries, you will please to do it. And suggestions as to any practicable remedies which might lead to improvement will be gratefully received.

Please to prepare and return answers to this circular, with your name annexed, on or before the ——— day of ——— 18 .

With much respect, I am your obedient servant,

———— ————

Secretary of the General Board of Health.

I. *Inquiries relating to the Natural and Atmospheric Condition of the Town*

1. What is the situation of the town ? as to the surrounding country ? as to its distance from the sea-shore or from tide-water ?

2. What is the exact latitude of the village, or the central part of the township ?

3. What number of square acres does the township contain ?

4. What are the general characteristics of the soil? its surface and its subsoil ? whether alluvial, sandy, clay, granite, or other kinds ? Are there any minerals in the town ? if so, what kind ? Are there any caves, caverns, or other peculiarities in the natural formation ?

5. Please to describe its general horizontal features; the plains and their extent; the hills, their frequency, extent, and height. What is the height of the town, in feet, above tide-water ? of its lowest elevation ? of its highest elevation ? of particular places ?

6. What is the extent and condition of the marshes, bogs, low meadows, swamps, and natural ponds ? Have they stagnant water ? and if so, how much, and where located ? and are they sometimes covered with water, and sometimes dry ? and are they sources of miasma or malaria ?

7. Please also to describe the rivers and streams of water. Are they stagnant, sluggish or rapid ? and are they subject to rise and fall, and to overflow their banks ? if so, at what seasons, and to what extent ? What is the number of feet of descent of each stream in its passage through the town ? and what is the quantity of water in square feet which passes in the stream, at a given point, each twenty-four hours ? the greatest quantity ? the least quantity ? the average quantity ?

8. In towns bordering on the ocean, how high does the tide rise and fall ? and what extent of land is covered at its flood and laid bare at ebb ?

9. What is the principal natural growth of forest trees and shrubs ? What plants and other vegetable productions grow in the town, which have been used for medicinal purposes ? Please to give a list of them, and state whether they are rare or in abundance, and for what purposes have they been used.

10. What insects, reptiles, fish, and other animal productions, are found in the town? Please to describe them, and state what kind, and in what season of the year they are found, or are most abundant.

11. Have meteorological registers been kept in the town? Can the variations of the barometer, thermometer, winds, weather, quantity of water in the form of rain and snow, the electric and other atmospheric phenomena, be shown, for different years and seasons? Are they the same in high as in low places? What is the date, in different places, of the appearance and disappearance of frost and snow? Are any places subject to fogs, and some more than others? What is the effect of the atmosphere in different places on the growth and preservation of fruit, and agricultural and other vegetable productions?

12. Please to specify and describe any other *natural* characteristic or peculiarity of the town worthy of notice.

II. *Inquiries relating to the Artificial and Local Condition of the Town*

13. How is the land of the town used? How much of it is unimproved, improved, covered with water; with wood; used for grazing, for grass, for tillage, or for other purposes? State about the quantity of each.

14. Have the swamps, low lands and meadows been cleared, drained, filled up, or otherwise changed from their natural state? or is stagnant water still permitted to remain?

15. Are the streams of water obstructed in the natural flowage by dams, or other causes? if so, for what purpose? and are parts of the adjacent lands sometimes overflowed and sometimes dry?

16. What is the extent of the densely populated part or district of the town? Is it crowded or otherwise?

17. Are the streets laid out nearly straight and at right angles, or are they irregular in their courses? what is their width? Are there narrow lanes, alleys, or courts, built upon? Are any courts closed at the end? Can the streets be extended into the suburbs, or are they obstructed? Are there open spaces for commons, parks, or for other purposes? if so, are they ornamented with trees or shrubbery?

18. Are the inhabitants well supplied with water? for domestic use? for cleansing the streets? for fires? by wells, or otherwise? Please to describe the mode of supply. What is the quality of the well or other water? Is it hard or soft, or will it wash with soap? Is it uniform or dissimilar in all places, or in the same place at all times? Has it been analyzed? if so, please to give the analysis and description.

19. Is there any public survey or plan of the town or district, containing a system of levels from a common data, for the information of builders, for the purpose of regulating public or private drainage, so as to protect the public health, or for convenience? Are the houses built on the natural elevation? if not, what changes have taken place? Is there any restriction as to the plan or mode of building?

20. What are the regulations for surface drainage? Are the streets, alleys and courts paved or unpaved? and are they laid out with proper inclinations for the discharge of the surface water, or are they uneven and favorable for

the retention of stagnant moisture and accumulation of refuse thereon from the houses? Are there any stagnant pools or open ditches, contiguous to the dwellings, or in the vicinity?

21. Are there any arrangements for under-drainage? if so, are they efficient or defective? Are there any sewers or branch drains from the houses to the streets? Do the contents of house privies empty into such sewers? Have they cesspools? Are the drains properly cleansed by water, or otherwise; or does the refuse accumulate therein, so that they become choked and emit offensive smells into houses or streets? Are there any means used to prevent the escape of such smells?

22. Are houses built on land redeemed from the ocean? if so, does the tide ebb and flow near or under the foundation? and does it produce dampness, or emit unpleasant smells?

23. What is the general structure and condition of the dwelling-houses? Are they built of brick or wood? Are they warmed by stoves or fire-places? lighted by gas or otherwise? ventilated? Are any houses built back to back, so as to obstruct the free circulation of the air? Have they proper privies? Are they provided with dust-bins and places for offal? Are there any cellar dwellings? if so, how are they lighted, warmed, and ventilated?

24. Are there public or private wash-houses and bathing-houses, to which the inhabitants are admitted? if so, are they free, or is a fee charged? what fee is charged?

25. Are there any buildings owned by incorporated or other companies, or by private individuals, for manufacturing purposes, where laborers congregate? Please describe them, and state their peculiarities.

26. Do any manufacturing establishments, slaughter-houses, or other works, supposed to be injurious to the public health, exist in or near the most densely populated parts of the town?

27. Are the churches, schoolhouses, almshouses, hospitals, and other public buildings, properly constructed as regards their site, light, heating apparatus, and ventilation? Please describe them, and their excellences and defects in these particulars. Have the schoolhouses open and convenient places for exercise and play-grounds? and are they provided with proper privies?

28. Please to describe any other peculiarity worthy of notice in the artificial and local condition of the town.

III. *Inquiries relating to the Number and Personal Condition of the Inhabitants*

29. What is the number of inhabitants in the town? Please to specify the number of each sex, and of each age (especially those under 15, from 15 to 60, and those over 60), and such other characteristics as are within your power to give.

30. What is the average number of persons to each acre? of the whole town? and of the most densely settled district or portion of the town?

31. What is the number of families? and the average number of persons to each family?

32. What has been the number of births, marriages, and deaths, for each of several years past?

33. What is the number of dwelling-houses? and the average number of persons to each? in the whole town? and in the most crowded district or portion of the town? How many persons have been found living in one room?

34. What is the aggregate full and true valuation of the estates? real? personal? total? and what is the total tax assessed, and the rate per cent on one hundred dollars of this full valuation? Please specify these facts for several past years.

35. What is the number of ratable polls? and the number of legal voters on the day of the annual election in November?

36. How many persons own real estate? and how many live in their own and how many in a rented house? and what is their proportion to the whole inhabitants?

37. What is the number of public schoolhouses? value of the schoolhouses? What sum of money was raised by tax last year for the support of public schools? What is the number of persons in town between five and fifteen years of age? How many of this number were at school at any time, more or less, during last year? How many, over twenty years of age, cannot read and write?

38. What is the number of places of religious worship? to what denomination of Christians do they belong? What number of sittings do they contain, or what number of persons will they accommodate? What is the cost of the churches? What are the annual expenses of public worship?

39. What is the general character of the inhabitants as to habits? whether industrious, temperate, or otherwise? as to means of subsistence, whether ample, moderate, or poor? What is their principal occupation?

40. What is the price of mechanical and other labor? for males? for females? including board? exclusive of board? Is there a demand for all labor offered? What is the price of some leading articles of provision? flour? meal? potatoes? etc. What is the price of wood? of coal? and which is most generally used?

41. Has any account been taken of the products of industry of the town? if so, please specify when such accounts were taken, and where the information may be obtained.

42. What is the number of public hotels or lodging-houses? where intoxicating liquor is sold? where it is not sold? What is the number of other places where such liquor is sold at retail? Are licenses granted to sell such liquor?

43. What is the number of public paupers? Please state the males and females separately, and the resident, non-resident, American, foreigners, and children of foreigners. What is the cause of their poverty? How many widows, orphans, or others, were made paupers by the death of friends on whom they depended for support?

44. How many inhabitants of the town, during the last year, were committed for trial for crime, and how many convicted? Please to state the place of birth, sex, age of each, if practicable.

45. Please to give any other valuable information bearing upon this division of the inquiries.

IV. *Inquiries relating to the Municipal Regulations and Sanitary Police of the Town*

46. Is there a board of health, who act independent of the mayor and aldermen of cities, or of the selectmen of towns? if so, when was it established, and what are its regulations? Are records of their proceedings preserved? Is there a health officer in town, to whom complaints concerning nuisances, and other matters relating to health, are made? if so, of what profession is he?

47. If the selectmen have acted as a board of health, when and for what purpose have they acted in that capacity? and have they preserved separate records of their proceedings relating to such matters?

48. Are scavengers or other persons appointed for cleansing streets, for the removal of offal, the refuse thrown from houses, night-soil, or other nuisances or impurities? if so, under whose direction do they act? Is such refuse used for agricultural purposes?

49. Have any means been adopted for the prevention of malaria, or the noxious emanations from ponds, swamps, or other unhealthy districts?

50. Has provision been made by the town for the vaccination of the children and other inhabitants? if so, how often has it been done, and under what regulations?

51. Have temporary or permanent hospitals been established or erected for the accommodation of the sick? if so, please to specify what they are, and for what purposes erected.

52. Are dispensaries provided for giving medical advice and medicine gratuitously to the poor? and do charitable societies exist for the relief of the poor during sickness? If either, please give an account of them.

53. Has any sanitary association been formed for the collection and diffusion of information relating to health?

54. How many places for the burial of the dead are there in the town? Please to describe each. The size, in square acres or rods. The date when first used as a burying-place. The distance from the village or densely populated parts of the town. Are they owned by the town or by associations? Is any one owned exclusively by any one religious denomination? Are they divided into lots and assigned to different families, or what regulations are adopted for the right of family or personal burial? What is the present condition of the burial-grounds? Are they well fenced, ornamented with trees, or otherwise? What number of persons were buried in each ground in each of the last five years? Are there any private or family burying-grounds not connected or included with those owned by the town or by companies? if so, please describe them. How many tombs are there in town, and how situated? Are any under churches? if so, how many, and are they used for burial? What number of bodies were interred in each burial-place under churches during the last year?

55. What are the established fees of burial to undertakers and others? What is the total cost of burial? Please state the particulars of several different bills for the expenses of interment.

56. Please to describe any excellency or defect in the sanitary police of the town.

V. *Inquiries relating to the Health, Sickness, and Mortality of the Inhabitants*

57. What is the general character and condition of the town, whether healthy or unhealthy? What is the state of the most unhealthy parts, or where the highest rate of mortality is supposed to occur? What are the causes usually assigned for such mortality?

58. What is the number in your town of each class or denomination of physicians? Which class receives the greatest patronage?

59. Have cases of fever, dysentery, or other epidemic, endemic, or contagious diseases, or others of fatal character, been of frequent or rare occurrence? If of frequent occurrence, please to give a list of such deaths, specifying the disease of which each died; and state whether it was mild or malignant in character; and under what circumstances or causes it occurred. Please also to state the same facts in each case in regard to consumption.

60. What was the aggregate annual amount of sickness suffered in different parts of the town, and among families and persons of different classes and occupations?

61. What was the amount of sickness in the public schools and other seminaries of learning in the town?

62. Please to give, from the most authentic sources within your power, the sanitary history and condition of the town in past years, specifying the healthy and sickly years, and the number of deaths, and causes of such sickness and deaths that happened in each. Please to give a list of the deaths; specify the ages for the last three or five years, according to the forms prescribed by the laws of the State, or by the General Board of Health.

63. State the *atmospheric causes of disease.* In what year and month of the year; and in what kind of weather and season, hot or cold, wet or dry, changeable or steady, or otherwise, did the diseases of different kinds occur? Whether on a hill, plain, or in a valley, exposed or protected from north, south, east or west winds? or in places subject to fogs or early frosts; and whether in a general epidemic or healthy season? Was there any peculiar circumstance observed in the appearance of insects, fish, or other animal life; or in vegetable productions; or in the electric or atmospheric phenomena? What other atmospheric cause occurred?

64. State the *local causes of disease.* Was it near to or distant from running water? or in the vicinity of marsh, bogs, low lands, drained or undrained, sometimes overflowed, sometimes dry; near stagnant water; natural or artificial mill or other ponds, constantly or occasionally full? or near other sources of malaria? Was it near any vegetable or animal matter in a state of decomposition; or other filth, impurities, or noxious exhalations, or unwholesome endemic influence, or contagious disease of any kind? Was the house or houses, in which different diseases occurred, unduly crowded or otherwise? properly lighted, warmed, and ventilated? supplied with pure water? Were the springs and wells high or low? State any other local cause.

65. State the *personal causes of disease.* Whether the persons or families were natives of the town, or of other parts of the United States, or foreigners, or children of foreigners. If not natives, how long resident in the town, or in

their particular place of abode. What was the profession or occupation of the head of the family in which sickness or death occurred, or of the person, if over fifteen years of age? What was his hereditary or acquired constitution? What was the means of subsistence of the family, whether ample, moderate, or poor? Did they own or rent the house in which they lived? Were they industrious in their habits, cleanly in their persons and habitations, temperate and prudent in their diet and mode of living, or otherwise? Had their previous general health been good? or had they been exposed to personal contagion? Was the cause accidental or otherwise? State any other personal cause.

66. In your opinion, what proportion of the sickness and mortality of the town might be prevented if the causes of disease were known, and the laws of health were understood and obeyed?

VI. *Conclusions and Recommendations suggested by the Facts elicited*

67. What inferences do you draw, what deductions do you make, or what conclusions do you derive, from the facts elicited? What suggestions would you make, or what measures would you propose or recommend, either municipal, social or personal, to improve the sanitary condition of the town or its inhabitants? Please to specify measures and remedies; and suggest a mode by which they may be practically applied, and successfully carried into execution.

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